



Course guide

390218 - ISM1 - Sensorisation and Data Acquisition

Last modified: 25/09/2023

Unit in charge: Barcelona School of Agri-Food and Biosystems Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering.

Degree: MASTER'S DEGREE IN ENABLING TECHNOLOGIES FOR THE FOOD AND BIOPROCESSING INDUSTRY (Syllabus 2014). (Compulsory subject).
MASTER'S DEGREE IN ENABLING TECHNOLOGIES FOR THE FOOD AND BIOPROCESSING INDUSTRY (Syllabus 2020). (Compulsory subject).

Academic year: 2023 **ECTS Credits:** 5.0 **Languages:** Spanish

LECTURER

Coordinating lecturer: Serrano Finetti, Ernesto

Others: Serrano Finetti, Ernesto

PRIOR SKILLS

Graduate students in science, engineering or technology disciplines with a diploma in areas close to agricultural engineering, food engineering or biosystems engineering, equivalent to 240 ECTS. Graduate students in science, engineering or technology disciplines with a diploma in areas close to agricultural engineering, food engineering or biosystems engineering, equivalent to 240 ECTS. Chemical engineering and biology, for example, also provide an acceptable background

REQUIREMENTS

Face-to-face lectures

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

1. Determination of the applicability to the food and bioprocesses sector of sensors and instrumentation techniques for measuring and data acquisition. Ability to detect the advantages and limitations of the diverse technologies and measurement equipments.
2. Ability to choose the measurement and acquisition data instrumentation in order to optimize the efficiency of the agri-food and biotechnological industries. Designing the implementation of the use and maintenance protocols of such systems.
3. Identification of the opportunities and knowledge of the scientific basis of nanotechnology application in the treatment of bioproducts. Identification of the benefits and risks of nanotechnology applied to food packaging and conservation.

Generical:

4. Ability to apply the language and techniques of industrial management in the agrifood and biotechnological sector
5. Identification of the industrial technologies with larger future impact and develop new applications of such technologies in the food and biotechnological industry.
6. Ability to identify and use monitoring systems in quality control of food products.
7. Ability to assess and improve the design of processes and products considering social and environmental impacts.

Transversal:

8. SUSTAINABILITY AND SOCIAL COMMITMENT: Being aware of and understanding the complexity of the economic and social phenomena typical of a welfare society, and being able to relate social welfare to globalisation and sustainability and to use technique, technology, economics and sustainability in a balanced and compatible manner.

9. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

TEACHING METHODOLOGY

The contents will be presented in theoretical sessions that will be complemented by application sessions in the laboratory. The theoretical sessions will be based on participatory expository sessions in which the theoretical concepts and their context of application will be presented. The theoretical sessions will include discussion activities, based on weekly assignments that have the purpose of applying the theoretical concepts, with emphasis on the approach, resolution methods and analysis of the results. The laboratory sessions will focus on experimentation with temperature sensors and 4-20 mA transmitters, the most widely used in the industry, as well as their digitization with a data acquisition system. The autonomous work will focus on the previously mentioned weekly assignments, and with which it is intended to consolidate the exposed knowledge.

LEARNING OBJECTIVES OF THE SUBJECT

This subject pursues the acquisition of the necessary knowledge to understand the characteristics of measurement systems and for the correct selection and use of measurement instruments and their auxiliary equipment, all this with the aim of achieving the greatest efficiency in the use of resources and the minimization of waste, improve control and greater productivity in the processes of the food and biotechnology industry.

The subject is composed of this first part that goes deeper into the bases of the instrumentation and methods to obtain the data, reinforcing concepts previously acquired in the degree studies of origin or in the subjects of the complements of the master's and in a second part where you get a detailed view of different specific measurement methods and techniques, as well as data acquisition.

STUDY LOAD

Type	Hours	Percentage
Self study	90,0	72.00
Hours large group	35,0	28.00

Total learning time: 125 h

CONTENTS

Topic 1: Fundamentals of measurement systems

Description:

Basic concepts and functions in instrumentation, types of measurements, uncertainty and calibration, dynamic response.

Related activities:

Laboratory practice 1

Full-or-part-time: 25h

Theory classes: 7h

Self study : 18h



Topic 2: Fundamentals of sensing

Description:

Fundamentals of sensors: methods, structure, interfaces and classification. Physical principles of the main types of sensors used in the food industry. Interferences between magnitudes and their compensation

Related activities:

Lab practice 1

Full-or-part-time: 17h

Theory classes: 5h

Self study : 12h

Topic 3: Fundamentals of non-invasive methods

Description:

Principles of operation of measurement methods based on electromagnetic fields and on electromagnetic and acoustic radiation and radioactive isotopes

Full-or-part-time: 22h

Theory classes: 6h

Self study : 16h

Tema 4: Técnicas instrumentales en la industria

Description:

Instrumental techniques for measurements in line, on line, at line. Assurance and quality control.

Full-or-part-time: 7h

Theory classes: 2h

Self study : 5h

Topic 5: Temperature, pressure, flow, level and relative humidity sensors

Description:

Characteristics of the main types of industrial sensors to measure temperature, pressure, flow, level and relative humidity, both invasive and non-invasive. Application examples.

Related activities:

Lab 1

Full-or-part-time: 30h

Theory classes: 8h

Self study : 22h

Topic 6: Chemical sensors and biosensors

Description:

Principles of operation, application examples.

Full-or-part-time: 7h

Theory classes: 2h

Self study : 5h



Topic 7: Data acquisition

Description:

Basic concepts and signal conditioning. Characteristic of commercial data acquisition systems. Signal conditioning for 4-20 mA transmitters.

Full-or-part-time: 17h

Theory classes: 5h

Self study : 12h

GRADING SYSTEM

Ongoing assessment based on 2 exams that last 2 hours; the first one around week 8 (N1) and the second one around week 14 (N2); also, the reports of two lab sessions (N3), and finally, on the participation in the sessions wherein homework is reviewed (N4). The final grade is $N = 0.35*N1 + 0.3*N2 + 0.2*N3 + 0.15*N4$.

EXAMINATION RULES.

Face-to-face written tests.

BIBLIOGRAPHY

Basic:

- Kress-Rogers, Erika; Brimelow, Christopher J. B. Instrumentation and sensors for the food industry [on line]. 2nd ed. Boca Raton [etc.] : Cambridge: CRC ; Woodhead, cop. 2001 [Consultation: 16/12/2021]. Available on: <https://www-sciencedirect-com.recursos.biblioteca.upc.edu/book/9781855735606/instrumentation-and-sensors-for-the-food-industry>. ISBN 084931223X.
- Eggins, Brian R. Chemical sensors and biosensors [Recurs electrònic] [on line]. Chichester, West Sussex: John Wiley & Sons, cop. 2002 [Consultation: 14/07/2022]. Available on: <https://onlinelibrary-wiley-com.recursos.biblioteca.upc.edu/doi/book/10.1002/9780470511305>. ISBN 9780470511305.

Complementary:

- Creus Solé, Antonio. Instrumentación industrial [on line]. 7ª ed. Barcelona: Marcombo, 2005 [Consultation: 23/07/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=9767. ISBN 8426713610.
- Pallás Areny, Ramón. Sensores y acondicionadores de señal. 4ª ed. Barcelona: Marcombo Boixareu, 2003. ISBN 8426713440.