390218 - ISM1 - Sensors and Data Acquisition

Coordinating unit: 390 - ESAB - Barcelona School of Agricultural Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering
Academic year: 2019
Degree: MASTER'S DEGREE IN ENABLING TECHNOLOGIES FOR THE FOOD AND BIOPROCESSING INDUSTRY (Syllabus 2014). (Teaching unit Compulsory)
ECTS credits: 5
Teaching languages: Spanish, English

Teaching staff
Coordinator: RAMON PALLAS ARENY
Others: Pallas Areny, Ramon

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 ETCS. 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 ETCS. Chemical engineering and biology, for example, also provide an acceptable background

Requirements
Presentiality.

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 choice the measurement and aquisition 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.

General:
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 indentify 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

Lectures will be based on interactive explanations in which theoretical concepts and their application will be presented. Application sessions will be devoted to apply theoretical concepts, with emphasis on the approach, problem solving methods and results analysis. They will foster open questions for discussion on the scope of theoretical concepts and their application to the cases studied. Exercises of implementation, which will be reviewed in the classroom, will be proposed each week to promote autonomous learning and consolidate knowledge.

Learning objectives of the subject

This subject comprises the concepts and skills required to select and correctly use and maintain measurement instruments and ancillary equipment in order to efficiently use water and energy, minimize waste, improve control and productivity, and fulfill regulations in agro-food and biotechnology industries.

The subject is organized in two parts. The first part deals on instrumentation fundamentals and measurement methods and will include an in-depth review of concepts dealt with in undergraduate courses or previous master courses. The second part is devoted to a detailed analysis of general measurement methods in process control engineering and specific methods used in bioprocess control.

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Study load

<table>
<thead>
<tr>
<th>Total learning time: 125h</th>
<th>Hours large group:</th>
<th>40h</th>
<th>32.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Guided activities:</td>
<td>5h</td>
<td>4.00%</td>
</tr>
<tr>
<td></td>
<td>Self study:</td>
<td>80h</td>
<td>64.00%</td>
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</tbody>
</table>
## Content

| **Sensors and measurement fundamentals** | **Learning time:** 45h  
Theory classes: 15h  
Self study: 30h |
|----------------------------------------|----------------------|
| **Description:**  
Sensors, fundamentals and characteristics of measurement systems, interference and data acquisition.  
Application examples of non-invasive systems based on infrared, ultrasound and other radiation. |

| **Instrumental techniques for in line, on line, and at line measurements** | **Learning time:** 30h  
Theory classes: 10h  
Self study: 20h |
|-----------------------------------------------|----------------------|
| **Description:**  
Instrumental methods for in-line, on-line and at-line measurements. Application to pressure, flow, temperature and level measurements in solids and liquids. |

| **Fast measurement methods in microbiology** | **Learning time:** 18h  
Theory classes: 6h  
Self study: 12h |
|-----------------------------------------------|----------------------|
| **Description:**  
Fast measurement methods in microbiology. Microscopy and flux cytometry, ATP estimation based on bioluminiscence, electrical impedance and conductance, and colorimetry. |

| **Chemical sensors and biosensors** | **Learning time:** 27h  
Theory classes: 9h  
Self study: 18h |
|------------------------------------|----------------------|
| **Description:**  
Chemical sensors and biosensors in the food and beverage industry. Examples of industrial disruptive techniques: e-noses. |

## Qualification system

Ongoing assessment

## Regulations for carrying out activities

Presentality. Continuous monitoring.
Bibliography

Basic:


Complementary:

Kress-Rogers, Erika; Brimelow, Christopher J. B. Instrumentation and sensors for the food industry. 2nd ed. Boca Raton [etc.]: Cambridge: CRC ; Woodhead, cop. 2001. ISBN 084931223X.