Course guide
390221 - CAG2 - Communication Systems and Production Management

Unit in charge: Barcelona School of Agri-Food and Biosystems Engineering
Teaching unit: 744 - ENTEL - Department of Network 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: 2022  ECTS Credits: 5.0  Languages: Spanish, English

LECTURER
Coordinating lecturer: Vidal Ferré, Rafael
Others: Consolación Segura, Carolina Maria
Gavaldà Aran, Xavier /
Benedito Benet, Ernest
Vidal Ferré, Rafael

PRIOR SKILLS
Scientific and technical degrees: graduates in agricultural engineering, food science and biosystems engineering (or related fields) with degrees of a duration equal to or greater than 240 ETCS.

REQUIREMENTS
Presentiality

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. Developing of criteria for selection and integration of robots and automatization systems in the food sector.
2. Ability to determine the communication and processing technologies appropiate for the control, production and distribution of food and bioproducts.
3. Designing the implementation of monitoring, control and automatization for food and biotechnological industries. Ability to detect the points of the productive chain susceptible of automatization.

General:
4. Ability to apply the language and techniques of industrial management in the agrifood and biotechnological sector
5. Applying of comercialization systems and logistics to the agri-food and bioprocesses sector.
6. Identification of the industrial technolgies with larger future impact and develop new applications of such technologies in the food and biotechnological industry.
7. Ability to indentify and use monitoring systems in quality control of food products.
8. Ability to assess and improve the design of processes and products considering social and environmental impacts.

Transversal:
9. 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.
TEACHING METHODOLOGY

Lecture: presentation of knowledge by university professors.
Participatory classes: collective solving exercises, conducted group discussions with the lecturer and other students in the classroom; classroom presentation of an activity individually or in small groups.
Theoretical and practical works: conducted classroom activity or exercise, individually or in small groups, with the advice of the lecturer.
Project or short works: based on the realization, individually or in groups, of a work of reduced complexity or scope.
Information search: Information search by students, it allows the acquisition of knowledge, skills and attitudes related to obtaining information.
Simulation: Activity related to a case or problem, each student or each group is assigned a role under which they must intervene in the development of the situation.
Evaluation activities.
LEARNING OBJECTIVES OF THE SUBJECT

Understand what communications networks are, their operating bases, the elements that form them and the parameters that define their behavior. Understand the concept of protocol stack and interconnection, differentiating types and equipment.

Know the operating bases of the Internet and local area networks (LANs), and more specifically Ethernet technology. Know the elements that are part of these networks as well as their organization and disposition.

Know the concept of the Industrial Communications Network (ICN) and its relationship with Control and Automation systems. Understand their operational requirements and the network mechanisms that allow them to be achieved. Understand the paradigm shift that the implementation of Industry 4.0 implies from the connectivity perspective. Identify the key technologies that allow its development.

Know the concepts of field bus and Industrial Ethernet, understand their generic operating bases and the specific ones of the most used technologies of each of these types of network.

Understand the benefits, limitations and general operating bases of wireless networks and in particular those of radio frequency. Learn about the most widely used technologies, their benefits and the most common use cases. Analyze commercial products related to the scope of the master's degree.

Know the concept of the Internet of Things (IoT), its relationship with Industry 4.0. Understand how IoT acts as a driver of innovation based on representative success stories. Analyze commercial solutions related to the scope of the master's degree. Understand the IoT value chain from the analysis of cases and the practical implementation of a proof of concept.

Acquire practical skills related to communication networks from the use of tools such as connectivity testing or coverage analysis.

Analytically estimate latency in a network and determine if an RCI is correctly dimensioned according to its performance, its size, number of elements to be controlled and the sampling frequency associated with its control.

Understand the importance of marketing and its objectives. Know its evolution and available technologies.

Understand the concept of interactive marketing, the importance of customer feedback, their loyalty and the establishment of long-term relationships.

Understand what supply chains (SC) are, their operating bases, the elements that form them and the parameters that define their transfer functions. Understand the concepts of direct, reverse and cross logistics.

Know the basic modules of the SC: warehouses, transport and transformations, understood as transfer functions, as well as the interactions between them.

Know the general field of application of the SC, differentiated from the concept of mobility.

Know the information and IT flows associated with SC.

Know the links and the role of IoT in SC management. Opportunities that the general IoT framework brings to the design, management and operation of SCs.

Understand the CS design based on the "business model (BM)" and its interaction: SC subject to the BM, but conditioning it.

Acquire practical skills in SC design and analysis in the context of IoT.

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>Self study</td>
<td>90,0</td>
<td>72.00</td>
</tr>
<tr>
<td>Hours large group</td>
<td>35,0</td>
<td>28.00</td>
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</tbody>
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Total learning time: 125 h
CONTENTS

FIRST PART

Description:
TOPIC 1: Networks and services of Telecommunications. Internet. 3.5 hours
Presentation of the subject. Fundamental concepts: network, service and application. Parameters and components of a network.
Fundamental functions: error, flow and congestion control; addressing and routing. Network interconnection. The Internet Protocol (IP) and IP addressing.

TOPIC 2: Local area networks. 3.5 hours
LANs: concept. Medium access protocols. Physical networks or MAC. Relationship with network level.

TOPIC 3: Industrial communications networks. 3 hours
The concept of field bus. Advantages and characteristics.

TOPIC 4: Field Buses and Industrial Ethernet 4,5 hours
Field buses: CAN and Profibus
Industrial Ethernet. Comparison of solutions based on response time.
The concept of Industry 4.0.
Presentation and discussion of advanced technologies based on Industrial Ethernet.

Related activities:
[CP1] [CP2]

Full-or-part-time: 40h 16m
Theory classes: 11h 15m
Guided activities: 1h
Self study : 28h 01m

SECOND PART

Description:
TOPIC 5: Wireless networks. 9.5 hours
General characteristics. Pros and cons. Basic concepts and regulation.
Standardized technologies (2G-5G, Wi-Fi, Bluetooth, NFC, RFID, VLC, UWB and GNSS), characteristics, features, products and uses.

TOPIC 6: Internet, Internet of Things and the Industrial Internet of Things. 12 hours
Internet. Evolution towards the Internet of Things (IoT). IoT architectures. IoT ecosystem. Particularities of the Industrial IoT (IIoT)
Wireless solutions for IoT. Evolution of existing standards (M2M, Wi-Fi and Bluetooth). Specific solutions for IoT (WSN, LPWANs) and IIoT (WirelessHART, ISA 100.11a and 6TiSCH).
Presentation and discussion of application scenarios, use cases and products and / or solutions.

Related activities:
[CP3] [CP4] [LAB0][LAB1]

Full-or-part-time: 59h 43m
Theory classes: 14h 35m
Guided activities: 4h
Self study : 41h 08m
THIRD PART

Description:
TOPIC 7: Interactive Marketing
Objectives, importance of marketing. Evolution and technologies to be used.
The customer's feedback loyalty and long-term relationships.

TOPIC 8: Logistics and distribution of the chain. Case study on food and bioprocesses. 6 hours
Introduction to the food logistics distribution sub-chain. Basic modules that compose it.
Introduction to the logistics sub-chain of food production and processing. Basic modules that compose it.
Inter-phase between both logistic sub-chains. Sub-division criteria.
KET in the logistics chain:
- Logistic technology
- Movement and micro transport units: intra-logistics.
- Algorithms of calculation and optimization of routes.
- Algorithms for the management of entrances, silo and warehouse exits.
- Trace in the food logistics chain. Conditions of the trace in transport and storage.
- SW of joint management of internal transport systems.
- Warehouse management SW, specialized in the area of food.
- Logistics of the transport of live animals.
- Reverse logistics.
- Dry, refrigerated, frozen and live products. Logistical constraints.

Full-or-part-time: 25h 01m
Theory classes: 7h 30m
Self study: 17h 31m

GRADING SYSTEM

Ongoing assessment:
35% topics 1 to 4: 50% group exercises + 50% exam
20% topic 5: 50% group exercises + 50% exam
24% topic 6: 20% laboratory questionnaire, 80% work
7% topic 7: exercise
14% topic 8: exercise or work

EXAMINATION RULES.

Presentiality. Ongoing assessment.

RESOURCES

Other resources:
Specific bibliography will be offered for each topic.