240EO016 - Process Automation

Coordinating unit: 240 - ETSEIB - Barcelona School of Industrial Engineering
Teaching unit: 707 - ESAII - Department of Automatic Control
Academic year: 2017
Degree: MASTER'S DEGREE IN MANAGEMENT ENGINEERING (Syllabus 2012). (Teaching unit Compulsory)
ECTS credits: 3  Teaching languages: Spanish

Teaching staff
Coordinator: Dr. Alberto Sanfeliu Cortés
Others: Dr. Manel Velasco

Degree competences to which the subject contributes

Specific:
1. Acquire concepts and techniques related to quantitative and experimental methods for analysis and decision making.
2. Apply theories and principles inherent in the production and logistics area in order to analyze complex situations and uncertainty, and make decisions using engineering tools.
3. Apply theories and principles relating to technology and information systems in order to analyze complex situations and uncertainty, and make decisions using engineering tools.
4. Identify, analyze, diagnose, design and implement solutions in complex socio-technical systems.

General:
5. Learn and master the analytical tools necessary for decision making in the organizational context more efficient.

Transversal:
6. ENTREPRENEURSHIP AND INNOVATION: Being aware of and understanding how companies are organised and the principles that govern their activity, and being able to understand employment regulations and the relationships between planning, industrial and commercial strategies, quality and profit.
7. 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.
8. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

Teaching methodology
In the course, master classes of theory, exercises and practices will be taught. There will be a two hour class session each week during 10 weeks and will combine the explanation of the concepts and techniques with sessions of problems. The practical classes will be carried out in two hour sessions during 4 weeks and the students will learn the use of the simulation language and the modelling and simulation of a system which will be gradually solved along the semester. The practical classes will be alternated with theory classes. Besides, the student will have to solve some practical exercises using a simulation language.

Learning objectives of the subject
The course aims to provide the students a panoramic view of the elements used in the automation systems and the basis of the designing techniques, simulation and validation of its control, both for discrete event systems and for continuous systems with feedback. The aim is to achieve a sufficient knowledge of the possibilities and limitations of its application.
Practices with a programming language will be carried out in this course

**Study load**

<table>
<thead>
<tr>
<th>Total learning time: 75h</th>
<th>Hours small group:</th>
<th>27h</th>
<th>36.00%</th>
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<tbody>
<tr>
<td>Self study:</td>
<td>48h</td>
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<td>64.00%</td>
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## Content

<table>
<thead>
<tr>
<th>1. Automation</th>
<th>Learning time: 3h</th>
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<tbody>
<tr>
<td></td>
<td>Theory classes: 1h</td>
</tr>
<tr>
<td></td>
<td>Self study: 2h</td>
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</table>

**Description:**
Basic concepts of automation of productive systems

**Specific objectives:**
Learn the basic concepts and the automation elements

<table>
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<tr>
<th>2. Modelling of systems by Petri networks</th>
<th>Learning time: 14h</th>
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<tbody>
<tr>
<td></td>
<td>Theory classes: 7h</td>
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<tr>
<td></td>
<td>Self study: 7h</td>
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</table>

**Description:**
Modelling techniques and analysis of discrete event systems by Petri Networks

**Related activities:**
Resolution of the exercises of Petri networks

**Specific objectives:**
Learn the normal and coloured Petri networks. Learn the analysis techniques of the Petri networks

<table>
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<tr>
<th>3. Simulation of discreet event systems</th>
<th>Learning time: 6h</th>
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<tbody>
<tr>
<td></td>
<td>Theory classes: 3h</td>
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<tr>
<td></td>
<td>Self study: 3h</td>
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**Description:**
Basic concepts of the discrete event systems, balancing of systems and comparison of the alternatives

**Related activities:**
Resolution of exercises

**Specific objectives:**
Learn the concepts of discrete event systems, balancing techniques and comparison of alternatives
## 4. Control systems and feedback

**Learning time:** 20h  
Theory classes: 9h  
Self study: 11h

**Description:**  
Basic concepts of the continuous control systems, modelling methods, analysis and design of controllers

**Related activities:**  
Resolution of exercises

**Specific objectives:**  
Learn the modelling techniques, analysis of control systems and the design of controllers

### Planning of activities

| 1. SIMULATION PRACTICES 1 | **Hours:** 8h  
Laboratory classes: 2h  
Self study: 6h |
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Learn the simulation language Arena</td>
</tr>
<tr>
<td><strong>Support materials:</strong></td>
<td>Software program of the Arena language for students</td>
</tr>
<tr>
<td><strong>Specific objectives:</strong></td>
<td>Learn the Arena simulation language for discrete events</td>
</tr>
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| 2. SIMULATION PRACTICES 2 | **Hours:** 24h  
Laboratory classes: 6h  
Self study: 18h |
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<tbody>
<tr>
<td><strong>Description:</strong></td>
<td>Learn to model and analyse a system using the programming language of discreet events Arena</td>
</tr>
<tr>
<td><strong>Support materials:</strong></td>
<td>Software program of the Arena language and documentation about the model to be implemented and analysed</td>
</tr>
<tr>
<td><strong>Specific objectives:</strong></td>
<td>Learn to model and analyse a system using the programming language of discreet events Arena</td>
</tr>
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A continuous evaluation of the student will be carried out by the realization of two exams and the evaluation of the exercises which will be assigned along the semester. The evaluation system will consist on:

- Evaluation of the first exam: 20% of the course mark
- Evaluation of the final exam: 60% of the course mark
- Evaluation of the exercises and practices: 20% of the course mark

Qualification system

Regulations for carrying out activities

The exams will consist on two parts, the first one will be of questions about theoretical concepts and the second one will be about the resolution of exercises

Bibliography

Basic:

