240EI515 - Industrial Scheduling

Coordinating unit: 240 - ETSEIB - Barcelona School of Industrial Engineering
Teaching unit: 732 - OE - Department of Management
Academic year: 2017
Degree: MASTER'S DEGREE IN INDUSTRIAL ENGINEERING (Syllabus 2014). (Teaching unit Compulsory)
ECTS credits: 4,5
Teaching languages: Catalan, Spanish

Teaching staff
Coordinator: Lusa García, Amaia
Others: Bruno Domenech, Jaume Ferrer-Dalmau, Xavier Garriga, Oscar Gil, Amaia Lusa, Manel Mateo, Joan Ignasi Moliné, David Palanques, Carles Rua, Rocío de la Torre, José Antonio Sánchez

Degree competences to which the subject contributes
Specific:
CEMEI09. Knowledge and abilities to organise and manage companies.

CEMEI10. Knowledge and strategy and planning abilities applied to different organizational structures.

CEMEI13. Knowledge in information systems for the management, industrial organization, production systems and logistics and quality management systems.
CEMEI15. Knowledge and abilities for the integrated management of projects.

Teaching methodology
The course consists of the following training activities:
* Theoretical sessions. A part of these sessions corresponds to a master class (lectures). And the rest is devoted to participatory-guided classes.
* Practical sessions. They correspond to a laboratory class where the students in groups of 3 or 4 apply quantitative tools in order to understand how to apply the procedures introduced in lectures.
* This is complemented by self study and an applied task; both are distance learning.
* Finally, we consider the evaluation activities (mid-term exam, exam on practical exercises and final exam).

Learning objectives of the subject
The decisions associated with the design (configuration, sizing and physical layout), the main problems that are presented in the configuration of a productive and logistic system are studied, and methods and tools are provided to solve them. For this, the basic theme related to the organization of these systems is presented, providing a basic conceptual vision and detailed instrumental elements.

Objectives to achieve:
* To know the basic scheme of decision-making in the medium-long term (systems design) and locate the problems raised.
* To know and know how to apply techniques to represent processes of any type.
* To know and know how to apply techniques to program the activities of a project.
* Be able to analyze various alternatives to the process-oriented layout, considering distances traveled, flows and other...
additional elements.
* Be able to design a basic production and assembly line.
* Be able to apply the appropriate tools (timing, sampling, default systems) to determine the time allotted to tasks.
* Be able to optimally configure a system formed by elements (e.g., machines) that must be attended by people
* To know different ways of organizing working time and be able to design systems based on work shifts.
* Be able to analyze the reliability of a system
* To know and know how to apply techniques and methods for process improvement
* To know the basic concepts about the maintenance of elements and systems (predictive, corrective, preventive). To know and to know to solve problems of renovation of elements.

**Study load**

<table>
<thead>
<tr>
<th><strong>Total learning time:</strong> 112h 30m</th>
<th>Hours large group:</th>
<th>27h</th>
<th>24.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours medium group:</td>
<td>13h 30m</td>
<td>12.00%</td>
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<tr>
<td>Guided activities:</td>
<td>0h</td>
<td>0.00%</td>
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<tr>
<td>Self study:</td>
<td>72h</td>
<td>64.00%</td>
<td></td>
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</tbody>
</table>
## Content

<table>
<thead>
<tr>
<th>0. Introduction</th>
<th>Learning time: 1h 30m</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Practical classes: 0h 30m</td>
</tr>
<tr>
<td></td>
<td>Self study : 1h</td>
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</tbody>
</table>

**Description:**
Concepts of production, production system, logistics and supply chain management. Classification of systems. Design decisions and operations management.

**Related activities:**
Theoretical lecture.

<table>
<thead>
<tr>
<th>1. Process description</th>
<th>Learning time: 8h 30m</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Practical classes: 1h 30m</td>
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<tr>
<td></td>
<td>Laboratory classes: 2h</td>
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<tr>
<td></td>
<td>Self study : 5h</td>
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</tbody>
</table>

**Description:**
Definición de proceso, cálculo de la capacidad de un proceso, técnicas para la representación gráfica y sintética de procesos.

**Related activities:**
Theoretical lecture. Short-duration activities. Exercises.

**Specific objectives:**
Know and know how to apply techniques to represent processes of any type.

<table>
<thead>
<tr>
<th>2. Project management</th>
<th>Learning time: 6h</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Practical classes: 2h</td>
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<tr>
<td></td>
<td>Laboratory classes: 0h</td>
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<tr>
<td></td>
<td>Self study : 4h</td>
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</tbody>
</table>

**Description:**
Definition. Several kinds of time constraints: cumulative, disjunctive... Treatment of disjunctions. Economic management of the project. Project organization and control.

**Related activities:**
Theoretical lecture. Short-duration activities. Exercises.

**Specific objectives:**
Determine the duration of a project depending on the amount of financial resources provided.
### 3. Layout

**Description:**
Introduction: classification, problems and goals. SLP method to design a plant layout: information collection, multi-product analysis of flows and distances, relationship diagrams, space relational diagrams, evaluation and optimization.

**Related activities:**
Theoretical lecture.
Short-duration activities.
Exercises.

**Specific objectives:**
Determining one or more alternatives to a layout considering distances, flows and other constraints.

<table>
<thead>
<tr>
<th>Learning time: 16h</th>
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<tbody>
<tr>
<td>Practical classes: 4h</td>
</tr>
<tr>
<td>Laboratory classes: 2h</td>
</tr>
<tr>
<td>Self study: 10h</td>
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</tbody>
</table>

### 4. Assembly line balancing

**Description:**
Concepts and techniques for the design of assembly lines

**Related activities:**
Explicació teòrica.
Activitat de curta durada.
Exercicis pràctics.

**Specific objectives:**
Design a basic production and assembly line

<table>
<thead>
<tr>
<th>Learning time: 12h</th>
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<tbody>
<tr>
<td>Practical classes: 2h</td>
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<tr>
<td>Laboratory classes: 2h</td>
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<tr>
<td>Self study: 8h</td>
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<tr>
<td><strong>5. Study of work time</strong></td>
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**Description:**
Timing (procedure, time units, the concept of activity, scales) and statistical analysis of the results. Sampling. Predetermined time systems; introduction to MTM systems. Organization of working time.

**Related activities:**
Theoretical lecture. Short-duration activities. Exercises.

**Specific objectives:**
- Estimate the time of a standard process and the number of observations required to establish a representative time.
- Estimate the proportion of working time devoted to an activity.
- Determine the time of a process based on predetermined time tables.
- Determine the amount of staff and shifts to meet requirements in a service.

<table>
<thead>
<tr>
<th><strong>6. Machine assignment</strong></th>
<th><strong>Learning time:</strong> 12h</th>
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<tbody>
<tr>
<td></td>
<td>Practical classes: 2h</td>
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<tr>
<td></td>
<td>Laboratory classes: 2h</td>
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<tr>
<td></td>
<td>Self study: 8h</td>
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</tbody>
</table>

**Description:**

**Related activities:**
Theoretical lecture. Short-duration activities. Exercises.

**Specific objectives:**
Determine the time and costs required for the allocation of machines to one or more workers.
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## 7. Working time organization

### Description:
Systems of organization of working time. Shift work.

### Related activities:
- Theoretical explanation.
- Short-term activity.
- Practical exercises.

### Specific objectives:
Know different ways of organizing working time and be able to design systems based on work shifts.

### Learning time: 14h
- Practical classes: 2h
- Laboratory classes: 2h
- Self study: 10h

## 8. Process improvement

### Description:
Process Improvement: steps, tools for continuous improvement... Learning curve.

### Related activities:
- Theoretical lecture.
- Short-duration activities.
- Exercises.

### Specific objectives:
Propose improvements of a process and evaluate them.

### Learning time: 12h
- Practical classes: 2h
- Laboratory classes: 2h
- Self study: 8h

## 9. Reliability

### Description:
Analysis and calculation of the reliability of a system.

### Related activities:
- Theoretical lecture.
- Short-duration activities.
- Exercises.

### Specific objectives:
Be able to analyze the reliability of a system.

### Learning time: 8h
- Practical classes: 2h
- Self study: 6h
The evaluation is done by several methods:

1. a final exam (EF), with a maximum of three hours duration, consisting of several theoretical and practical exercises in which the student must demonstrate the ability to apply learned knowledge and to develop specific procedures of resolution;
2. a mid-term exam (PP), with a maximum of 1h15' duration, in which the student is basically faced to intellectual agility questions and short exercises;
3. an exam about exercises (EP), with a maximum of 1 hour duration, in which the student must demonstrate that he/she is able to solve situations slightly different from those worked out in class;

The final grade for the course Nfinal will be obtained:

\[ N_{\text{final}} = 0.6 \cdot N_{\text{EF}} + 0.2 \cdot N_{\text{EP}} + 0.2 \cdot N_{\text{PP}} \]

NEF: Final exam
NEP: Practical exam
NPP: Mid-term exam

If the student attends to the reevaluation exam (REA), this mark will replace the one obtained in the final exam (EF).

**Qualification system**

**Description:**
Maintenance and renewal

**Related activities:**
Theoretical lecture.
Short-duration activities.
Exercises.

**Specific objectives:**
To know the basic concepts about the maintenance of elements and systems (predictive, corrective, preventive).
To know and to know to solve problems of renovation of elements.

**Learning time:**
10h
- Practical classes: 2h
- Self study: 8h

**Regulations for carrying out activities**

The final exam (EF), the mid-term exam (PP), the exam about exercises (EP) and the reevaluation exam (REA) are open books. Electronic devices are not allowed, except pocket calculator (mobile phone or any other devices are not allowed).

In case a test is included in the final exam, none material can be used in that part.
Bibliography

Basic:


Complementary:


Others resources:

Organització Industrial. Transparències (in Spanish)
Organització Industrial. Enunciats de les pràctiques (in Catalan and Spanish)