240EI024 - Integrated Manufacturing Systems

Coordinating unit: 240 - ETSEIB - Barcelona School of Industrial Engineering
Teaching unit: 712 - EM - Department of Mechanical Engineering
Academic year: 2019
Degree: MASTER'S DEGREE IN INDUSTRIAL ENGINEERING (Syllabus 2014). (Teaching unit Compulsory) MASTER’S DEGREE IN AUTOMOTIVE ENGINEERING (Syllabus 2019). (Teaching unit Optional) MASTER’S DEGREE IN AUTOMOTIVE ENGINEERING (Syllabus 2012). (Teaching unit Optional)
ECTS credits: 3
Teaching languages: Catalan, Spanish

Teaching staff
Coordinator: Irene Buj Corral
Others: Joan Ramon Gomà Ayats
Lluís Costa Herrero

Prior skills
Basic knowledge in manufacturing.

Degree competences to which the subject contributes
Specific:
CEMEI02. Knowledge and ability to project, calculate and design integrated manufacturing systems.

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Learning objectives of the subject
General objective: The general objective of the subject is to provide students with knowledge and capabilities that are necessary to identify, evaluate, compare and select most appropriate elements that allow integrating manufacturing systems. Basically computer assisted elements used for manufacturing, which allow their integration, are treated.

Specific objectives: See specific objectives and programmed activities of each lesson.
### Study load

<table>
<thead>
<tr>
<th></th>
<th>Hours large group:</th>
<th>17h</th>
<th>22.67%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours small group:</td>
<td>10h</td>
<td></td>
<td>13.33%</td>
</tr>
<tr>
<td>Guided activities:</td>
<td>0h</td>
<td></td>
<td>0.00%</td>
</tr>
<tr>
<td>Self study:</td>
<td>48h</td>
<td></td>
<td>64.00%</td>
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</tbody>
</table>
# 240EI024 - Integrated Manufacturing Systems

## Content

<table>
<thead>
<tr>
<th>1. Numerical Control (NC) Machines</th>
<th>Learning time: 20h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 8h</td>
</tr>
<tr>
<td></td>
<td>Laboratory classes: 2h</td>
</tr>
<tr>
<td></td>
<td>Self study : 10h</td>
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</tbody>
</table>

**Description:**


**Related activities:**

Advanced programming with NC exercises. Laboratory class 1 to see the manufacture of parts programmed with NC and different NC Machines in the Manufacturing Technology Workshop of ETSEIB and in CIM Centre Foundation (UPC).

**Specific objectives:**

To provide students with knowledge and skills required to identify, evaluate, compare and select: basic elements that characterize numerical control machines, functions and features of CNC programming, applications and possibilities of numerical controls, and type of machinery where it can be applied.

<table>
<thead>
<tr>
<th>3. Assembly systems</th>
<th>Learning time: 8h</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Theory classes: 2h</td>
</tr>
<tr>
<td></td>
<td>Laboratory classes: 2h</td>
</tr>
<tr>
<td></td>
<td>Self study : 4h</td>
</tr>
</tbody>
</table>

**Description:**

Lay-out of assembly systems, rigid or random transport systems, rigid and flexible assembly systems.

**Related activities:**

Application exercises.

**Specific objectives:**

To provide students with knowledge and skills required to identify, evaluate, compare and select: functions and possibilities of transport systems.
## 2. Computer Aided Manufacturing (CAM)

**Learning time:** 15h
- Theory classes: 6h
- Self study: 9h

**Description:**
Introduction. Concepts. Types of CAM programs. Generation of NC programs using a CAM program. Other types of CAM programs to simulate metal sheet forming, forging, casting, plastic injection, etc.

**Related activities:**
Exercises with MasterCam in the Computer Laboratory. Manufacture of workpieces in the Manufacturing Technology Workshop of ETSEIB.

**Specific objectives:**
To provide students with knowledge and skills required to identify, evaluate, compare and select: functions and possibilities of CAM programs for generating numerical control programs, as well as functions and possibilities of CAM programs for simulating manufacturing processes.

## 4. Flexible Manufacturing

**Learning time:** 10h
- Theory classes: 4h
- Self study: 6h

**Description:**

**Related activities:**
Application exercises.

**Specific objectives:**
To provide students with knowledge and skills required to identify, evaluate, compare and select: functions and possibilities of different elements that allow automated flexible manufacturing.

## 5. Computer Integrated Manufacturing (CIM)

**Learning time:** 6h
- Theory classes: 2h
- Self study: 4h

**Description:**

**Related activities:**
View videos on the topic.

**Specific objectives:**
To provide students with knowledge and skills required to identify, evaluate, compare and select: functions and possibilities of different elements that allow computer integrated manufacturing.
Qualification system

Qualification is based on four types of evaluations: a partial test, a final exam, evaluation of laboratory and workshop sessions, and evaluation of the semestral work. In the partial test and the final exam theoretical and practical knowledge from the classes as well as application knowledge from the rest of the sessions are assessed. Laboratory and workshop sessions are evaluated from the questionnaire that the students will fill in at the end of every class, taking into account understanding degree, clear writing and presentation of the answers. In the class work, both the report, regarding content, structure, clearness and presentation, as well as the oral presentation to the colleagues, with help of Power Point, with content and clearness of the slides as well as quality of oral presentation will be evaluated.

Algorithm for calculation of final mark is:

\[ N_{\text{final}} = 0.1 \cdot N_{\text{LRT}} + 0.1 \cdot N_{\text{CTC}} + 0.8 \cdot \max\{NEF; 0.63 \cdot NEF + 0.4 \cdot NPP\} \]

with:  
NLT: Qualification of Laboratory and Workshop Sessions.  
NTC: Qualification of Semestral Work.  
NEF: Qualification of Final Exam.  
NPP: Qualification of Partial Test.

Reevaluation:

Reevaluation exam assesses all theory and exercises content of the course. Mark obtained in the reevaluation exam NER will substitute marks NPP of the Partial Test and NEF of the Final Exam.

\[ N_{\text{final}} = 0.1 \cdot N_{\text{LRT}} + 0.1 \cdot N_{\text{CTC}} + 0.8 \cdot \text{NER} \]

In order to go to reevaluation exam it is necessary, at least, to have attended one final exam of the subject during the same academic year.

Regulations for carrying out activities

Rules for tests and exams:

Nothing can be taken either to the theory part nor to the exercises part of exams.

6. Computer Aided Manufacturing Process Simulation

<table>
<thead>
<tr>
<th>Description:</th>
<th>Learning time: 6h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Related activities:</td>
<td>Self study: 4h</td>
</tr>
<tr>
<td>Practiques de laboratori.</td>
<td></td>
</tr>
<tr>
<td>Specific objectives:</td>
<td></td>
</tr>
<tr>
<td>To provide students with knowledge and skills required to identify, evaluate, compare and select: functions and possibilities of software that allows simulation of processes.</td>
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</table>
Bibliography

Basic:


Complementary:


Others resources:

Audiovisual material

Sistemas Integrados de Fabricación. Apuntes

Sistemas Integrados de Fabricación: Material docente preparado por el equipo de profesores de la asignatura.