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 2012). (Teaching unit Optional)
MASTER' S DEGREE IN AUTOMOTIVE ENGINEERING (Syllabus 2019). (Teaching unit Optional)
ECTS credits: 3  Teaching languages: Catalan, Spanish

Teaching staff
Coordinator: Irene Buj Corral
Others: Joan Ramon Gomà Ayats
Lluís Costa Herrero
Dominguez Fernandez, Alejandro
Minguella Canela, Joaquim
Uceda Molera, Roger

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.
CEEMEC3. Use the design tools CAD/CAM/CAE, the numerical simulation CFD and the dynamic simulation for the design and advanced calculation of facilities and fluid dynamic systems.

Teaching methodology
Learning methodology is based on three kinds of activities: theory classes, exercise classes and laboratory classes. In the classes, the teacher introduces the subject, provides concepts and knowledge, and by means of practical exercises or application examples, helps to understand the content. In some classes exercises or problems are proposed to be solved at home, which help to consolidate knowledge. The laboratory classes combine the Manufacturing Technology Laboratory and the computer rooms. At the laboratory, different numerical control machines, which are used for machining parts, are shown. At the end of the laboratory and workshop sessions the students in groups will have to answer a set of questions/exercises about taught knowledge in the corresponding session.

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>Study load</th>
<th>Hours large group:</th>
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<th>Hours small group:</th>
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<tbody>
<tr>
<td><strong>Total learning time:</strong> 75h</td>
<td>17h</td>
<td>22.67%</td>
<td>10h</td>
<td>13.33%</td>
<td>0h</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>48h</td>
<td>64.00%</td>
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<td><strong>Content</strong></td>
<td><strong>Learning time:</strong> 3h</td>
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| **1-Manufacturing Systems** | **Theory classes:** 1h 30m  
**Self study:** 1h 30m |
| **Description:** | Introduction, types of productive systems, types of manufacturing systems, basic components of the manufacturing systems. |
| **Related activities:** | Theory class. |
| **Specific objectives:** | To provide students with knowledge and skills required to identify, evaluate, compare and select the basic components of the manufacturing systems. |

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<th><strong>2-Numerical Control (NC) Machines</strong></th>
<th><strong>Learning time:</strong> 13h</th>
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</table>
| | **Theory classes:** 4h 30m  
**Laboratory classes:** 2h  
**Self study:** 6h 30m |
| **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. |
| **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. |
### 3-Assembly systems

**Description:**
Lay-out of assembly systems, rigid or random transport systems, rigid and flexible assembly systems

**Related activities:**
Theory class and exercises.

**Specific objectives:**
To provide students with knowledge and skills required to identify, evaluate, compare and select: functions and possibilities of transport systems.

**Learning time:** 6h
- Theory classes: 3h
- Laboratory classes: 0h
- Self study: 3h

### 4-Automated manufacturing

**Description:**

**Related activities:**
Theory class and laboratory classes 2, 3, 4 and 5 with the CAM (computer assisted manufacturing) software Cimatron.

**Specific objectives:**
To provide students with knowledge and skills required to identify, evaluate, compare and select the different function automatization systems.

**Learning time:** 3h
- Theory classes: 1h 30m
- Laboratory classes: 0h
- Self study: 1h 30m

### 5-Flexible Manufacturing Systems

**Description:**

**Related activities:**
Theory class. 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.

**Learning time:** 6h
- Theory classes: 3h
- Self study: 3h
### 6-Preparation of machines

**Learning time:** 6h  
Theory classes: 3h  
Self study: 3h

**Description:**  
Manufacturing in small batches. SMED methodology.

**Related activities:**  
Theory class. Exercises.

**Specific objectives:**  
To provide students with knowledge and skills required to identify, evaluate, compare and select different systems for preparing machines.

### 7-Computer Integrated Manufacturing

**Learning time:** 3h  
Theory classes: 1h 30m  
Self study: 1h 30m

**Description:**  
Introduction. Unattended manufacturing, Data capture and analysis. Management of computer integrated systems. 4.0 Factory.

**Related activities:**  
Theory class.

**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.

### 8-Design for manufacturing

**Learning time:** 3h  
Theory classes: 1h 30m  
Self study: 1h 30m

**Description:**  

**Related activities:**  
Theory class.

**Specific objectives:**  
To provide students with knowledge and skills required to identify, evaluate, compare and select different systems of design for manufacturing.
Qualification is based on four types of evaluations: a partial test, a final exam, evaluation of laboratory sessions and an exam of the laboratory classes. In the partial test and the final exam theoretical and practical knowledge from the classes as well as exercises. Laboratory sessions are evaluated from the questionnaire that the students will fill in at the end of every class, as well as from the exam of the laboratory classes.

Algorithm for calculation of final mark is:
\[ N_{\text{final}} = 0.1 \times NSL + 0.1 \times N_{\text{IP}} + 0.8 \times \max[NEF, 0.6 \times NEF + 0.4 \times NPP] \]
with:  
- \( NSL \): Qualification of Laboratory and Workshop Sessions.  
- \( N_{\text{IP}} \): Individual qualification of the laboratory classes.  
- \( NEF \): 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 \( N_{\text{ER}} \) will substitute marks \( NPP \) of the Partial Test and \( NEF \) of the Final Exam.

\[ N_{\text{final}} = 0.1 \times N_{\text{LT}} + 0.1 \times N_{\text{TC}} + 0.8 \times N_{\text{E}} \]
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.
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.