330510 - EG2 - Graphic Expression 2

Coordinating unit: 330 - EPSEM - Manresa School of Engineering
Teaching unit: 717 - EGE - Department of Engineering Presentation
Academic year: 2019
Degree: BACHELOR'S DEGREE IN AUTOMOTIVE ENGINEERING (Syllabus 2017). (Teaching unit Compulsory)
ECTS credits: 4,5
Teaching languages: English

Teaching staff

Coordinator: Lopez Martinez, Joan Antoni
Others: Romero Rodriguez, Jose Antonio

Degree competences to which the subject contributes

Basic:
CB1. Students will be able to demonstrate their knowledge of a field of study that builds on secondary education and is usually found at a level that, while supported by advanced textbooks, also includes aspects that involve knowledge of the latest developments in the field of study.
CB2. Students will be able to apply their knowledge to their work or vocation in a professional manner and demonstrate that they possess the competencies that are typically demonstrated by elaborating and defending arguments and solving problems in the field of study.

Specific:
CES5. Spatial vision capacity and knowledge of graphic representation techniques, both by traditional methods of metric geometry and descriptive geometry, and by computer aided design applications.

General:
CG3. Knowledge of basic and technological subjects that will enable students to learn new methods and theories and that will endow them with the versatility needed to adapt to new situations.
CG10. The ability to work in a multilingual and multidisciplinary environment.

Transversal:
1. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 1. Planning oral communication, answering questions properly and writing straightforward texts that are spelt correctly and are grammatically coherent.
2. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.
3. THIRD LANGUAGE. Learning a third language, preferably English, to a degree of oral and written fluency that fits in with the future needs of the graduates of each course.
Learning objectives of the subject

- OAG05. To possess the knowledge that allows us to understand the norms and systems of representation in mechanical design, and the spatial vision necessary to read and interpret the plans for a project.
- OAG06. To present the standardised and non-standard elements related to mechanical design in order to conceive and design mechanisms through a series of CAD practices.
- OAG07. Capacity for spatial vision and knowledge of graphic representation techniques, either by traditional means of metric and descriptive geometry or using CAD applications.
- OAG08. Acquisition of the graphic language of mechanisms, machines and installations in the field of industrial engineering.
- OAG09. Experimentation with the use of graphic engineering and CAD applications.
- OAG10. To obtain the knowledge necessary for interpreting and carrying out the graphic design of any project.
- OAG11. Knowledge and skills to apply graphic engineering techniques.
- OAG12. Knowledge and skills for calculating, designing and testing machines.

Study load

<table>
<thead>
<tr>
<th>Total learning time: 112h 30m</th>
<th>Hours large group:</th>
<th>0h</th>
<th>0.00%</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Hours medium group:</td>
<td>0h</td>
<td>0.00%</td>
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<tr>
<td></td>
<td>Hours small group:</td>
<td>45h</td>
<td>40.00%</td>
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<tr>
<td></td>
<td>Guided activities:</td>
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<tr>
<td></td>
<td>Self study:</td>
<td>67h 30m</td>
<td>60.00%</td>
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</tbody>
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Teaching methodology

MD1 Master class or lecture (EXP)
MD2 Problem solving and case study (RP)
MD4 Directed theoretical and practical work (TD)
MD5 Small-scale project, activity or assignment (PR)
MD7 Assessment activities (EV)

The subject consists of three hours per week in a small group in the graphic expression laboratory, where theoretical concepts are taught and immediately worked on through practical exercises, using either traditional tools or computer-aided design (CAD) tools.
### Content

<table>
<thead>
<tr>
<th>Types of technical drawings and content</th>
<th>Learning time: 6h 25m</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td></td>
</tr>
<tr>
<td>01.01. Drawings of industrial products: assemblies and parts</td>
<td>Practical classes: 2h 25m</td>
</tr>
<tr>
<td>01.02. Standard components</td>
<td>Self study: 4h</td>
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<tr>
<td>01.03. Graphic representations of industrial machinery and facilities</td>
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<td>01.04. Graphic representations in civil engineering</td>
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<td>01.05. Graphic representations in architecture</td>
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<tr>
<td>01.06. Graphic representations in industrial designs</td>
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<tr>
<td><strong>Related activities:</strong></td>
<td></td>
</tr>
<tr>
<td>1,2</td>
<td></td>
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<tr>
<td><strong>Specific objectives:</strong></td>
<td></td>
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<tr>
<td>OAG05, OAG06, OAG07, OAG08, OAG11, OAG12</td>
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<table>
<thead>
<tr>
<th>Surface finishing and symbols</th>
<th>Learning time: 6h 25m</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description:</strong></td>
<td></td>
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<tr>
<td>02.01. Classification of surfaces</td>
<td>Practical classes: 2h 25m</td>
</tr>
<tr>
<td>02.02. Roughness. Characteristic concepts and parameters</td>
<td>Self study: 4h</td>
</tr>
<tr>
<td>02.03. Surface finish symbols</td>
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<tr>
<td>02.04. Indication of the surface finish in drawings (UNE-1037-83)</td>
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<tr>
<td>02.05. Indication of knurled surfaces (DIN-82)</td>
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<tr>
<td><strong>Related activities:</strong></td>
<td></td>
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<tr>
<td>1,2</td>
<td></td>
</tr>
<tr>
<td><strong>Specific objectives:</strong></td>
<td></td>
</tr>
<tr>
<td>OAG05, OAG06, OAG07, OAG08, OAG11, OAG12</td>
<td></td>
</tr>
</tbody>
</table>
# Dimensional tolerances and fits

**Description:**
- 03.01. Introduction to tolerances and exchangeability
- 03.02. The concept of tolerance and characteristic parameters
- 03.03. Representation of tolerances by limits, deviations and classes
- 03.04. The quality and position of tolerances
- 03.05. Preferred tolerances and general tolerances
- 03.06. The transfer of elevations
- 03.07. The concept, representation and indication of a fit
- 03.08. Types of fit and parameters
- 03.09. ISO fit systems: standard holders and standard shafts
- 03.10. Preferred fits

**Related activities:**
1, 2

**Specific objectives:**
OAG05, OAG06, OAG07, OAG08, OAG11, OAG12

**Learning time:** 6h 25m
- Practical classes: 2h 25m
- Self study: 4h

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# Geometric tolerancing

**Description:**
- 03.11. Geometric tolerancing typology
- 03.12. Symbols and meanings
- 03.13. Norms on geometric tolerancing
- 03.14. UNE 1-121: 1991-1
- 03.15. Indication
- 03.16. Rectangle tolerance, reference elements
- 03.17. General tolerances

**Related activities:**
1, 2

**Specific objectives:**
OAG05, OAG06, OAG07, OAG08, OAG11, OAG12

**Learning time:** 6h 25m
- Practical classes: 2h 25m
- Self study: 4h
### Standard components in threaded joints

**Learning time:** 6h 25m  
**Practical classes:** 2h 25m  
**Self study:** 4h

| Description |  
|-------------|---|
| 04.01. Thread systems and threaded components  
04.02. Screws, bolts, pins, threaded rods, nuts, washers, safety washers and retaining rings.  
04.03. Dimensional characteristics and geometric shapes  
04.04. Standard names  
04.05. Standard tables of components  
04.06. Standard representation of threaded components and joints |  

| Related activities |  
|-------------------|---|
| 1,2 |  

| Specific objectives |  
|---------------------|---|
| OAG05, OAG06, OAG07, OAG08, OAG11, OAG12 |  

### Standard components in unthreaded joints

**Learning time:** 6h 25m  
**Practical classes:** 2h 25m  
**Self study:** 4h

| Description |  
|-------------|---|
| 05.01. Cylindrical, conical, butterfly-winged, taper grooves and roll pins  
05.02. Pins and pegs  
05.03. Dimensional characteristics and geometric shapes  
05.04. Standard names  
05.05. Standard tables of components  
05.06. Standard representation of unthreaded components and joints  
05.07. Representation of components in assembly drawings |  

| Related activities |  
|-------------------|---|
| 1,2 |  

| Specific objectives |  
|---------------------|---|
| OAG05, OAG06, OAG07, OAG08, OAG11, OAG12 |  

### Shafts and drive shafts

**Description:**
- 06.01. Standard geometries and dimensions
- 06.02. Graphic representation of drive shafts
- 06.03. Cylindrical and conical shaft ends (DIN 748 and DIN 1448)
- 06.04. Grooved, ribbed and splined shafts. Standards and graphic representation
- 06.05. Representation of components in assembly drawings

**Related activities:**
1,2

**Specific objectives:**
OAG05, OAG06, OAG07, OAG08, OAG11, OAG12

**Learning time:** 6h 25m  
Practical classes: 2h 25m  
Self study: 4h

### Springs

**Description:**
- 07.01. Classification according to shape, selection of wire and type of load.
- 07.02. Representation and dimensioning according to UNE-EN ISO 2162.
- 07.03. Section and simplified representations of traction springs, compression springs, torsion springs, spiral springs and leaf springs.
- 07.04. Table of characteristics of springs.
- 07.05. Representation of springs in assembly drawings.

**Related activities:**
1,2

**Specific objectives:**
OAG05, OAG06, OAG07, OAG08, OAG11, OAG12

**Learning time:** 6h 25m  
Practical classes: 2h 25m  
Self study: 4h
### Bush and roller bearings

**Description:**
- 08.01. Representation and dimensioning of plain bearings.
- 08.02. Roller bearings: components, types, types of load and dimension series.
- 08.03. Characteristics, regulations, standard names and the specific graphic representation of roller bearings: rigid ball bearings, angular contact ball bearings, swivel ball bearings, cylindrical rollers, conical rollers, thrust ball bearings, cylindrical roller bearings and needle roller bearings.
- 08.04. General simplified and detailed representation of each type of roller.
- 08.05. Radial and axial mounting of rollers. Representation and dimensioning.
- 08.06. Gears. Graphic representation according to geometries and dimensions.

**Related activities:**
1,2

**Specific objectives:**
OAG05, OAG06, OAG07, OAG08, OAG11, OAG12

**Learning time:** 6h 25m
- Practical classes: 2h 25m
- Self study: 4h

### Gears and trains

**Description:**
- 09.01. Types: cylindrical with straight teeth, cylindrical with helical teeth; conical, worm and crown gears.
- 09.02. Fundamental graphic dimensions and parameters. Definitions.
- 09.03. Characteristics and dimensions.
- 09.04. Standard representation of the different types of gear.
- 09.05. Table of characteristics of a cogwheel.

**Related activities:**
1,2

**Specific objectives:**
OAG05, OAG06, OAG07, OAG08, OAG11, OAG12

**Learning time:** 6h 25m
- Practical classes: 2h 25m
- Self study: 4h
## Chain, cable and belt drives

**Learning time:** 6h 25m  
Practical classes: 2h 25m  
Self study: 4h

### Description:
- 10.01. Types.
- 10.02. Chain cable and belt drives. Definitions.
- 10.03. Characteristics and dimensions.
- 10.04. Standard and simplified representation.

### Related activities:
1, 2

### Specific objectives:
- OAG05, OAG06, OAG07, OAG08, OAG11, OAG12

## Cams and eccentrics

**Learning time:** 6h 25m  
Practical classes: 2h 25m  
Self study: 4h

### Description:
- 11.01. Definitions.
- 11.03. Graphic representation of an eccentric. Layout.

### Related activities:
1, 2

### Specific objectives:
- OAG05, OAG06, OAG07, OAG08, OAG11, OAG12
## Welding

**Description:**
12.01. Classification of welding procedures.
12.03. Designation of welded joints.

**Related activities:**
1, 2

**Specific objectives:**
OAG05, OAG06, OAG07, OAG08, OAG11, OAG12

### Learning time:
- Practical classes: 2h 25m
- Self study: 4h

## Representations in the shaping of sheet metal

**Description:**
13.01. Working with sheet metal
13.02. Development
13.03. Bending formulas
13.04. Deformation operations
13.05. Representations

**Related activities:**
1, 2

**Specific objectives:**
OAG05, OAG06, OAG07, OAG08, OAG11, OAG12

### Learning time:
- Practical classes: 2h 25m
- Self study: 4h
Planning of activities

**ACTIVITIES AND PROJECTS**

<table>
<thead>
<tr>
<th>Description:</th>
<th>Hours: 19h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activities and projects aimed at using and acquiring subject knowledge. These can be individual or in groups.</td>
<td>Self study: 8h 30m</td>
</tr>
<tr>
<td></td>
<td>Practical classes: 10h 30m</td>
</tr>
</tbody>
</table>

**Support materials:**
Atenea material and CAD.

**Descriptions of the assignments due and their relation to the assessment:**
Oral presentation or Atenea.

**Specific objectives:**
OAG09, OAG10

**Previous to final exam**

<table>
<thead>
<tr>
<th>Description:</th>
<th>Hours: 6h</th>
</tr>
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<tbody>
<tr>
<td>Individual assessment test.</td>
<td>Practical classes: 3h</td>
</tr>
<tr>
<td></td>
<td>Self study: 3h</td>
</tr>
</tbody>
</table>

**Support materials:**
Exam papers.

**Descriptions of the assignments due and their relation to the assessment:**
Completed test.
10% of final mark.

**Specific objectives:**
OAG09, OAG10

Qualification system

A continuous assessment model is applied in order to assess both the independent work and the teamwork of the students.

Knowledge, skills and abilities will be assessed as follows:
- Individual and group work during the whole course: 40%
- Preliminary exam at the end of the course: 10%
- Final exam: 50%
Regulations for carrying out activities

- Face-to-face sessions of content presentation and exercise solving.
- Face-to-face sessions of practical work.
- Independent work of studying, doing exercises and seeking and analysing information.
- Preparing and carrying out assessable group activities.

Bibliography

Basic:


Complementary:


Others resources: