240652 - Engineering of the Product

Coordinating unit: 240 - ETSEIB - Barcelona School of Industrial Engineering
Teaching unit: 758 - EPC - Department of Project and Construction Engineering
Academic year: 2019
Degree: BACHELOR’S DEGREE IN INDUSTRIAL TECHNOLOGY ENGINEERING (Syllabus 2010). (Teaching unit Optional)
BACHELOR’S DEGREE IN MATERIALS ENGINEERING (Syllabus 2010). (Teaching unit Optional)
BACHELOR’S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2010). (Teaching unit Optional)
ECTS credits: 4,5

Teaching languages: Catalan

Teaching staff
Coordinator: Joaquim Lloveras Macià

Opening hours
Timetable: Tuesday 11h30 a 12h30
Thursday from 11h30 a 12h30

Prior skills
Basic knowledge of mechanical engineering or electrical and electronics, or materials, or chemical processes

Degree competences to which the subject contributes

Specific:
CEM2. Knowledge on mechanical, electronic, chemical and biologic behaviour of materials, and capacity to apply this behaviour into design, calculation and modelling of aspects of elements, components and equipment.
CET19B. Capacity to analyse, design, simulating and optimising processes and products.
CE15. Basic knowledge of industrial production systems.

Transversal:
05 TEQ. TEAMWORK. Being able to work as a team player, either as a member or as a leader. Contributing to projects pragmatically and responsibly, by reaching commitments in accordance to the resources that are available.
02 SCS. SUSTAINABILITY AND SOCIAL COMMITMENT. Being aware of and understanding the complexity of social and economic phenomena that characterize the welfare society. Having the ability to relate welfare to globalization and sustainability. Being able to make a balanced use of techniques, technology, the economy and sustainability.

Teaching methodology
The classes will have the first part of summarized explanations, this theory applies to the second part of the class will be tutoring the work group was preparing engineering design of an innovative product.
Students will form working groups between 4 to 6 students, trying to integrate different specialties, choose a theme and work with the approval of the teacher.
Work engineering design of a product will be presented (oral and written), groups of students by mid course and end of the course. We promote the questions between groups.

Learning objectives of the subject

General objective
240652 - Engineering of the Product

Students learn and practice how to focus and development of engineering product design, with emphasis on product innovation, especially in the conceptual design phase.

Specific Objectives
- Knowledge of lifecycle product engineering in relation with the Ecodesign.
- The actions that lead to have a conceptual design directed.
- The tasks for a conceptual design defined.
- The analysis to have a viable conceptual design.
- Knowledge of Patents.
- Aspects of the detailed design and prototyping.

<table>
<thead>
<tr>
<th>Study load</th>
<th>Total learning time: 112h 30m</th>
<th>Hours large group:</th>
<th>0h</th>
<th>0.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hours medium group:</td>
<td>45h</td>
<td>40.00%</td>
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<tr>
<td></td>
<td>Hours small group:</td>
<td>0h</td>
<td>0.00%</td>
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<tr>
<td></td>
<td>Guided activities:</td>
<td>0h</td>
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<tr>
<td></td>
<td>Self study:</td>
<td>67h 30m</td>
<td>60.00%</td>
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</table>
1. Lifecycle of a product in relation with the Ecodesign.

**Description:**
The life cycle of a product begins with the individual obtaining the materials that compose and ends with its scrapping. The Eco-design tries to minimize the environmental impact throughout the product life cycle.

**Related activities:**
Examples of lifecycles.

**Specific objectives:**
- Giving an overview of life cycles by analyzing each of them.
- Prepare the main concepts and design phases of a design project.
- Prepare to apply concepts further analysis of the life cycle of the product, to Ecodesign.

2. Actions to have a conceptual design directed

**Description:**
The first step for a conceptual design of product innovation is to work towards the innovation. So, aspects that can be innovated are search, for example to implement new features, or new materials, or new automation. Are applied creativity techniques, or TRIZ, and provide several ideas for alternative solutions. State of Art and industrial property are searched. Finally, to define a basic architecture of the product and its functions will obtain the conceptual design directed, and then move to another stage where further development and analysis of the chosen solution for product innovation.

**Related activities:**
- Internet search in databases of patents.
- Creativity sessions to innovate the product.
- If appropriate, prepare surveys, collect information and analyze it.

**Specific objectives:**
- Search aspects of innovation.
- Using creative techniques.
- Find product information and similar patents.
- Functional requirements.
3. Tasks to achieve a conceptual design defined.

**Learning time:** 5h
Practical classes: 5h

**Description:**
Already obtained the direction of conceptual design where it is headed the new product, several actions are made to define the conceptual design. Will apply different methodologies to mature design as: Ecodesign, User Centered Design, Ergonomics, Safety design, Simplification of design.

**Related activities:**
Working sessions of group discussion of solutions or improvements.

**Specific objectives:**
- Ecodesign: MET Matrix, and Ecoperfil Ecoindicators.
- Concepts of User Centered Design
- Concepts of Ergonomics
- Safe design: cause-effect diagram, Failures tree (FTA). Hazop. FMEA.
- Simplification of design

4. Activities to have a viable conceptual design

**Learning time:** 3h
Practical classes: 3h

**Description:**
All stages of design are recurrent and interactive, but there is a final stage of analysis of the feasibility of the design concept defined above, which analyzes the advantages and disadvantages that the innovated product has, as well as their viabilities: technical and normative, economic, environmental and social, before moving on to the next phase of detailed design.

At this stage (or in other), to watch the behavior of the product is made a virtual modeling, or a manual physical prototype, or by 3D printers, to help to define the final product and its technical feasibility.

The following phases of product design will be explained.

**Related activities:**
Making a virtual model, or physical of product or a part of it, in its case, with a 3D printer.

**Specific objectives:**
- Concepts of viabilities: technical and normative, economic, environmental and social.
- Modelling.
## 5. Drafting of a patent

**Learning time:** 2h 30m  
Practical classes: 2h 30m

### Description:
Having overcome the three phases of conceptual design, before the detailed design can proceed with drafting a patent of the product innovation. Protecting intellectual property is needed to capitalize on designs developed. The same task of drafting a patent obligues to specify and refine the invention also helps to find more alternative solutions. Will make a basic patent drafting of innovated product.

### Related activities:
Schematic drawings of the product, and patent drafting.

### Specific objectives:
- Better understand as they are the patents.
- Learn how to write a patent.
# Planning of activities

## First design

<table>
<thead>
<tr>
<th>Description:</th>
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<tbody>
<tr>
<td>This is the first documentation of the work group to be submitted towards half course. Will define conceptual design of product innovation.</td>
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<table>
<thead>
<tr>
<th>Support materials:</th>
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<tbody>
<tr>
<td>Written documentation (paper and digital)</td>
</tr>
<tr>
<td>Slides of the presentation (digital)</td>
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<table>
<thead>
<tr>
<th>Descriptions of the assignments due and their relation to the assessment:</th>
</tr>
</thead>
<tbody>
<tr>
<td>It will consist of a presentation of a written text with indicated sections and an oral presentation of the same, where each student will present in about 5 minutes a part of the work of the group, so all the students of the group will give a whole vision of the work. At the end of the oral presentation of each group, the lecturer and other groups will make assessments of the work presented and questions.</td>
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<table>
<thead>
<tr>
<th>Specific objectives:</th>
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<tbody>
<tr>
<td>To develop personal skills of creativity and rationality in design to product innovation.</td>
</tr>
<tr>
<td>To develop teamwork skills and expression of it.</td>
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<tr>
<td>Have knowledges of the process of product design.</td>
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<tr>
<th>Hours:</th>
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<tr>
<td>15h</td>
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Laboratory classes: 15h

## Final design

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<th>Description:</th>
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<tbody>
<tr>
<td>It is the final documentation of the work group. Analyze feasibility of a first conceptual design of the product innovated and is will write the patent. In its case, will present a computer model, or prototype made manually, or by 3D printer.</td>
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</tr>
<tr>
<td>Slides of the presentation (digital)</td>
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<tr>
<td>Computer model or Prototype, if necessary.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Descriptions of the assignments due and their relation to the assessment:</th>
</tr>
</thead>
<tbody>
<tr>
<td>The final written documentation will be presented according to the indicated sections. There will be an oral presentation of the work, where each student will present in about 5 minutes a part of the work of the group, so all the students of the group will give a overall view of the work. At the end of the oral presentation of each group, the lecturer and other groups will make assessments of the work presented and questions. Will be delivered the model or prototype.</td>
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<table>
<thead>
<tr>
<th>Specific objectives:</th>
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<tbody>
<tr>
<td>To develop teamwork skills and expression of it.</td>
</tr>
<tr>
<td>Knowledges of the process of product design. Drawing solutions.</td>
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<tr>
<td>Knowledges of patents.</td>
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<tr>
<td>Prototyping.</td>
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<table>
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<tr>
<th>Hours:</th>
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<tbody>
<tr>
<td>15h</td>
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</tbody>
</table>

Laboratory classes: 15h
Qualification system

If approved by course, the final grade will be:
\[ N_{c} = 0.5 \ N_{gr} + 0.5 \ N_{ind} \]
The student's grade will be made in case of the final exam:
\[ N_{ef} N_{fae} = 0.6 + 0.4 \ N_{c} \]

where:
- \( N_{c} \) = Course grade
- \( N_{gr} \) = Note group, obtained \( N_{pr2} = 0.6 + 0.2N_{pr1} + 0.2 \ N_{pfo} \)
- \( N_{pr2} \) = Note of the final document
- \( N_{pr1} \) = Note of the previous document (half course)
- \( N_{pfo} \) = Note of group of the final oral presentation

\[ N_{ind} = \text{single note, obtained } 0,6 \ N_{vp} + 0,4 \ N_{poi} \]
- \( N_{vp} \) = Note of teacher assessment of student work and assistance
- \( N_{poi} \) = Note of individual oral presentation
- \( N_{fae} \) = Note of final exam
- \( N_{ef} \) = Note of final exam

Regulations for carrying out activities

Presentations of written documentation:
- The first documentation of the work will be presented to middle course.
- The final documentation will be submitted a week before the end of the course.

Oral Presentations:
- Students will make two oral presentations about 5 minutes each, half year and end of the course, which will expose part of their job presented with the group, so that all the students in the group to give an overall view of job.
- At the end exposure of each group, the teacher and other groups will evaluate work presented and questions.
- Assessed the quality of the final presentation, each individual participation and the whole group.

Final written or reevaluation exam:
- Each exam question will be notated his highest score.
- The maximum duration of the examination will be one hour and a half.
- It is evaluated concision in the responses.
- It is not allowed to have notes or electronic devices.
- The teacher will attend only the questions related to the clarification of the text of the questions.
Bibliography

Basic:


Complementary:


Others resources:

Hyperlink

http://www.triz40.com/TRIZ_GB
Resource

http://www.oepm.es/es/index
Resource

http://www.ihobe.net/Publicaciones/Listado.aspx?IdMenu=750e07f4-11a4-40da-840c-0590b91bc032
Resource

http://www.qfdi.org
Resource

http://en.wikipedia.org/wiki/Creativity
Resource