Course guide
240652 - 240652 - Engineering of the Product

Last modified: 16/05/2023

Unit in charge: Barcelona School of Industrial Engineering
Teaching unit: 758 - EPC - Department of Project and Construction Engineering.

Degree: BACHELOR'S DEGREE IN INDUSTRIAL TECHNOLOGY ENGINEERING (Syllabus 2010). (Optional subject).

Academic year: 2023 **ECTS Credits:** 4.5 **Languages:** Catalan

LECTURER

Coordinating lecturer: Joaquim Lloveras Macià

Others:

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.
CETI9B. 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
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 whith the Ecodesign.
· The actions 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.

STUDY LOAD

Type	Hours	Percentage
Self study	67,5	60.00
Hours medium group	45,0	40.00

Total learning time: 112.5 h

CONTENTS

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.

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.

Related activities:
Examples of lifecycles.

Related competencies :
CE15. Basic knowledge of industrial production systems.
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.

Full-or-part-time: 1h 30m
Practical classes: 1h 30m

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.

Specific objectives:
Search aspects of innovation.
Using creative techniques.
Find product information and similar patents.
Functional requirements.

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

Related competencies :
CE15. Basic knowledge of industrial production systems.
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.

Full-or-part-time: 3h
Practical classes: 3h

3. Tasks to achieve a conceptual design defined.

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.

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

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

Related competencies :
CETI9B. Capacity to analyse, design, simulating and optimising processes and products.
CE15. Basic knowledge of industrial production systems.
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.

Full-or-part-time: 5h
Practical classes: 5h

4. Activities to have a viable conceptual design

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.

Specific objectives:
Concepts of viabilities: technical and normative, economic, environmental and social.
Modelling.

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

Related competencies :
CETI9B. Capacity to analyse, design, simulating and optimising processes and products.
CE15. Basic knowledge of industrial production systems.

Full-or-part-time: 3h
Practical classes: 3h

5. Drafting of a patent

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.

Specific objectives:
Better understand as they are the patents.
Learn how to write a patent.

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

Related competencies :
CETI9B. Capacity to analyse, design, simulating and optimising processes and products.
CE15. Basic knowledge of industrial production systems.

Full-or-part-time: 2h 30m
Practical classes: 2h 30m

ACTIVITIES

First design

Description:
This is the first documentation of the work group to be submitted towards half course.
Will define conceptual design of product innovation.

Specific objectives:
To develop personal skills of creativity and rationality in design to product innovation.
To develop teamwork skills and expression of it.
Have knowledges of the process of product design.

Material:
Written documentation (paper and digital)
Slides of the presentation (digital)

Delivery:
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.

Related competencies :
CETI9B. Capacity to analyse, design, simulating and optimising processes and products.
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.

Full-or-part-time: 15h
Laboratory classes: 15h

Final design

Description:
It is the final documentation of the work group.
Analyze feasibility of a first conceptual design of the product innovatedand is will write the patent.
In its case, will present a computer model, or prototype made manually, or by 3D printer.

Specific objectives:
To develop teamwork skills and expression of it.
Knowledges of the process of product design. Drawing solutions.
Knowledges of patents.
Prototyping.

Material:
Written documentation (paper and digital)
Slides of the presentation (digital)
Computer model or Prototype, if necessary.

Delivery:
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.

Full-or-part-time: 15h
Laboratory classes: 15h

GRADING SYSTEM

If approved by course, the final grade will be:
Nc = 0.5 Ngr + 0.5 Nind
The student's grade will be made in case of the final exam:
Nef Nfae = 0.6 + 0.4 Nc

where:
Nc = Course grade
Ngr = Note group, obtained Npr2 = 0.6 + 0.2Npr1 + 0.2 Npfo
Npr2 = Note of the final document
Npr1 = Note of the previous document (half course)
Npfo = Note of group of the final oral presentation

Nind = single note, obtained = 0,6 Nvp + 0,4 Npoi
NVP = Note of teacher assessment of student work and assistance

Npoi= Note of individual oral presentation
Nfae = Note of final exam
Nef = Note of final exam

EXAMINATION RULES.

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:
- Pugh, Stuart. Total design: integrated methods for successful product engineering. Wokingham, England: Addison-Wesley, 1990. ISBN 0201416395.
- Suh, N.P. The principles of Design. New York: Oxford University Press, 1990. ISBN 0195043456.
- Pahl, Gerhard ; Beitz, W. Engineering design: a systematic approach [on line]. 3rd. London: Springer, 2007 [Consultation: 05/04/2017]. Available on: http://dx.doi.org/10.1007/978-1-84628-319-2. ISBN 9781846283185.

Complementary:
- IHOBE. Sociedad Pública de Gestión Ambiental. Manual práctico de ecodiseño : operativa de implantación en 7 pasos [on line]. Bilbao: País Basc. Gobierno. IHOBE. Sociedad Pública de GEstión Ambiental, 2000 [Consultation: 05/04/2023]. Available on: https://www.ihobe.eus/publicaciones/manual-practico-ecodiseno-operativa-implantacion-en-7-pasos-2.
- Boothroyd, Geoffrey. Product design for manufacture and assembly. 2nd ed. New York: MArcel Dekker, 2002. ISBN 082470584X.

- Lloveras, Joaquin. "A process of conceptual engineering design for new patentable products". International Conference on Engineering Design (18a : 2011 : København, Denmark). 18th International Conference on Engineering Design : 15-18 August 2011 Technical University of Denmark. København: The Design Society, 2011. p. 78-87.
- Creus Solé, Antonio. Fiabilidad y seguridad: su aplicación en procesos industriales. 2a ed. Barcelona: Marcombo, 2005. ISBN 8426713629.

RESOURCES

Hyperlink:
- http://www.oepm.es/es/index. Resource
- http://en.wikipedia.org/wiki/Creativity. Resource
- http://www.ihobe.net/Publicaciones/Listado.aspx?IdMenu=750e07f4-11a4-40da-840c-0590b91bc032. Resource
- http://www.triz40.com/TRIZ_GB. Resource
- http://www.qfdi.org. Resource