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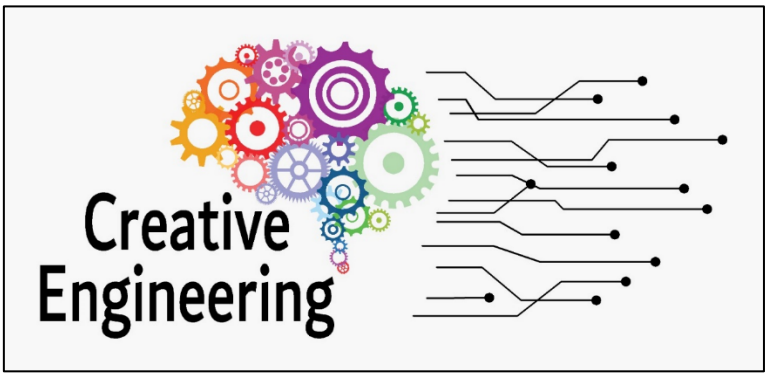

Curriculum “Design Thinking”

2022-1-SK01-KA220-HED-000090102

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CONTENT

1 DESIGN THINKING

Core Unit Title: Creative Engineering
Training Module Title: Design thinking: Creative engineering methods

1.1 Competence Unit

The aim of this competence unit and learning outcomes is to equip students with necessary skills and knowledge to manage design thinking and creative engineering methods in their future work as engineers, to work collaboratively in teams and to use the creativity in the designing of new products and services.

1.2 Learning Outcomes

1.2.1 Competences

After successfully completing the subject "Communication for Creative Engineering", students are able to demonstrate the following competencies, skills and knowledge:

1.2.2 Competencies

A – Specific Competences (related to the core unit)

Code	Competence Description
A1	Apply knowledge of the different areas involved in the training plan.
A2	Need for permanent and continuous learning and especially oriented towards advances, techniques and new products on the market.
A3	Work effectively as an individual and as a member of diverse, multidisciplinary teams.
A4	Ability to design, write and direct projects, in all their diversity and phases.
A5	Ability to use modern and creative techniques, skills and tools for engineering practice.

B – Basic Engineering Competences

Code	Competence Description
B1	Effective oral and written communication skills with ethics and social responsibility as a citizen and as a professional.
B2	Apply critical, logical and creative thinking to question reality, seek and propose innovative solutions at a formal, functional and technical level.
B3	Learn to learn. Ability to understand and detect the dynamics and mechanisms that structure and emergence and dynamics of new creative trends.
B4	Work collaboratively. Learn about group dynamics and teamwork.
B5	Work autonomously with initiative.

Code	Competence Description
B6	Leadership and decision-making capacity.
B7	Communicate effectively in a work environment.
B8	Organization and planning capacity.
B9	Capacity for analysis and synthesis.

C – Transversal Competences

Code	Competence Description
C1	Express yourself correctly, both orally and in writing, in the official languages.
C2	Use the basic tools of information and communication technologies (ICT) necessary for the exercise of the profession and for learning throughout the life.
C3	Develop for the exercise of citizenship that respects democratic culture, human rights and the gender perspective.
C4	Understand the importance of creativity in an entrepreneurial culture and know the means available to entrepreneurial people.
C5	Develop the ability to work in interdisciplinary or transdisciplinary teams, to offer proposals that contribute to sustainable environmental, economic, political and social development.

1.2.3 Skills

Skill	Linked Competences		
To acquire knowledge about design thinking and creative engineering methods	A1	B3	C4
To learn to use the design thinking methodology	A2	B2	C3
To become familiar with the use of creative engineering methods	A2	B2	C3
In general, acquire basic knowledge of creativity methods necessary to for the subsequent application in engineering projects.	A3 A4 A4	B1 B4 B5 B6 B7 B8 B9	C1 C2 C5

1.2.4 Knowledge

1. **Design thinking: Creative engineering methods**
   - Definition of design thinking and methodology (3h THEORETICAL)
   - Introduction to design thinking
   - Definition of Design Thinking
   - Design thinking skills
   - Design thinking methodology

2. **Creative engineering methods (3h THEORETICAL)**
    - Creative engineering methods
    - Creative engineering methods: practice
    - Portfolio design instructions
3. **Creation of a technical project: Portfolio (3h PRACTICAL)**
4. **Evaluation**
5. **Bibliography**

1.3 Evaluation Criteria

Evaluation method	Competences	Description
Rubric for teacher evaluation, self-assessment and peer evaluation	A1 A2 A3 B2 B3 B4 B5 B6 B7 C4 C5	Observe students during design thinking activities or projects and provide opportunities for them to reflect on their process, decisions, and outcomes. This can be done through written reflections, oral presentations, or group discussions. Use case studies, conduct interviews or debate to assess students' understanding and application of design thinking principles. This can involve analysing their responses to hypothetical scenarios or real-world examples, assessing their ability to identify and address user needs. Rubric is very useful to collect these observations. In addition, encourage students to evaluate their own work and provide constructive feedback to their peers. This promotes self-reflection and develops critical evaluation skills, as well as fostering collaboration and communication within the classroom.
Portfolio evaluation	A4 A5 B1 B8 B9 C1 C3	Have students maintain design journals or portfolios to document their design process, including sketches, ideation notes, prototypes, and reflections. This allows to assess their ability to iterate, reflect, and communicate their design thinking journey.

		It would be fantastic if a company could be involved in the project. In this sense, we could add expert evaluation in the process.
Presentation evaluation	A4 A5 B1 B8 B9 C1 C2 C3	Have them present their solutions and explain their design process, allowing for evaluation of their ability to empathize, define problems, ideate, prototype, and iterate. It would be fantastic if a company could be involved in the project. In this sense, we could add expert evaluation in the process.

1.4 Methodological Strategies

Strategy	Description
Lectures	The lectures or main sessions will be carried out in the classroom; power point presentations, videos and other materials will be used. The students will take notes about fundamental concepts explained in the classroom and then expand on the concepts by consulting recommended bibliography. In addition, students will be provided with tools such as summaries or diagrams, which they will be able to access through the web or the online platform used in each university. This methodology will be used in competence units 1 and 2. During the class different dynamics could be used that are reflected in pedagogical methods.
Technical project	The students must do a technical project in order to put in practice the concepts of the module. This project can be performing with a company. This methodology will be used in competence unit 3. To create the portfolio and construct the project the students must follow the following instructions: – Identification of a problem or necessity in one sector. – Selection of methodology or process to follow. – Selection of 3 creative engineering methods. – Application of the creative engineering methods. – Presentation of the results and the solution achieved.

1.5 Pedagogical Methods

- **Brainstorming sessions.** This method will be used in lectures to introduce a new concept. In this way a group activity where participants generate a large number of ideas without evaluation or criticism, encouraging a free flow of creative thinking.
- **Debates.** In order to evaluate the participation of students and the level of learning, debates could be used in lectures.
- **Flipped classroom.** The students sometimes must prepare some concepts before theoretical class. This pedagogical method increases the level of attention of students during the lecture and engage them in their own learning.

1.6 Means and Resources Required

- Classroom with internet connection for presentations.
- Online platform for sharing contents.
- Optional: webpage.
- Optional: contents with companies for projects.

1.7 Learning assessment

Methodologies		Competences	Description	Qualification
Lectures (face to face classes)		A1 A2 A3 B2 B3 B4 B5 B6 B7 C4 C5	The students will be evaluated during the debates and brainstorming sessions in the lectures by mean of the rubric.	20
Technical project	Portfolio	A4 A5 B1 B8 B9 C1 C2 C3	The purpose of creative methods, the application in the practical case and the quality of the document will be assessed	50
	Online presentation		The quality of the presentation, the ability to express and speak in public and the ability to answer the questions	30

	about the project will be evaluated

1.8 Mode of delivery

In order to be green all shared materials of module, even portfolio, must be delivered online.

2 RECOMMENDED OR REQUIRED READING

2.1 Recommended reading

- Brown, T. & Wyatt, J. (2010). Design Thinking for Social Innovation. *Stanford Social Innovation Review*, 30-35.
- Engel. (2018). *Practical creativity and innovation in systems engineering.* Wiley.
- Florida, R. (2010). *La clase creativa. La transformación de la cultura del trabajo y el ocio en el siglo XXI.* Ediciones Paidós Ibérica.
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- Mentzer, N., Becker, K., & Sutton, M. (2015). Engineering Design Thinking: High School Students' Performance and Knowledge. *Journal of Engineering Education*, 104(4), 417- 432. http://doi.org/10.1002/jee.20105.
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- Pusca, D. & Northwood, D.O. (2019). Curiosity, creativity and engineering education. *Global Journal of Engineering education*, 20 (3), 152-158.
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- Tschimmel, K. (2012). Design Thinking as an effective Toolkit for Innovation. In: *Proceedings of the XXIII ISPIM Conference: Action for Innovation: Innovating from Experience.* Barcelona. ISBN 978-952-265-243-0.

- Wade, & Piccinini, T. (2020). Teaching Scenario Planning in Sustainability Courses: The Creative Play Method. *Journal of Management Education,* 44(6), 699–725. https://doi.org/10.1177/1052562920958136

2.2 Required reading

- Arce Fariña, López-Vázquez, J.-A., Fernández-Ibáñez, I., Zayas-Gato, F., Ribas, J. R., & Suárez-García, A. (2021). *Design Thinking: experiencia en graos STEAM.* https://doi.org/10.17979/spudc.9788497498180.013
- Beckman, S. L., y Barry, M. (2007). Innovation as a Learning Process: Embedding Design Thinking. *California Management Review*, 50 (1), 25-56. https://doi.org/10.2307/41166415
- Brooks, Lainio, A., & Lažetić, P. (2020). Using creative methods to research across difference. An introduction to the special issue. *International Journal of Social Research Methodology*, 23(1), 1–6. https://doi.org/10.1080/13645579.2019.1672281
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- Prado-Acebo, C. (2023). *Escenarios de aprendizaje. Historia, diseño e influencia del espacio arquitectónico universitario en el proceso de enseñanza-aprendizaje mediante metodologías activas.* [Tesis doctoral, Universidade da Coruña].
- Rowe, P. (1987). *Design thinking.* MIT Press.

3 DETAILED CONTENT FOR THE COURSE

Language of the course:
Names of the lectures:
Teaching hours: 30 hours
Mode of delivery: distance, online
Notes:

1. **Definition of design thinking and methodology (3h THEORETICAL)**
   - Introduction to design thinking
   - Definition of design thinking
   - Design thinking skills
   - Design thinking methodology
2. **Creative engineering methods (3h THEORETICAL)**
   - Creative engineering methods
   - Creative engineering methods: practice
   - Portfolio design instructions
3. **Creation of a technical project: Portfolio (3h PRACTICAL)**
4. **Evaluation**