BACHELOR'S DEGREE IN INDUSTRIAL DESIGN ENGINEERING

SYLLABUS
INTELLIGENT MANUFACTURING AND SYSTEMS

ACADEMIC YEAR: 2025-26
GRADE: 3rd-4th
CHARACTER: Optional
SEMESTER: 2nd
ECTS: 6
TEACHING HOURS: 45
HOURS OF SELF-EMPLOYMENT: 105
TOTAL HOURS: 150
LANGUAGE/S: català/castellano
CODE: 17060

TEACHING TEAM: Xavier Riudor xriudor@elisava.net / Pau Benazet pbenazetm@elisava.net

PRESENTATION OF SUBJECT / OBJECTIVES
Emerging technologies are transforming every stage of the life cycle of products, services and systems, from their development and manufacture with innovations with technologies such as the recognition of 3D physical models and the collection of real-time data processed by artificial intelligence to power intelligent systems such as XR (Extended Reality) and Digital Twins (Digital Twins). New methodologies for computer vision and 3D photogrammetry make it possible to offer visual recognition systems adapted to any environment in real time. In Digital Twin systems, 3D manufacturing and data management with AR (Augmented Reality) technologies such as Iot (Internet of Things) will allow real-time interaction with physical prototypes.

SUSTAINABLE DEVELOPMENT GOALS (SDGS)
This subject does not specifically incorporate any SDGs.

CONTENTS
Block-I: Theory and concepts
- Digital Twins: Definition and Concepts
- Digital Twins and Industry 4.0
- 3D Scanning and Reconstruction Technologies of physical models
- Development of Extended Reality (XR) applications
- Enabling Technologies: Modelling and Simulation,
- Artificial Intelligence, Application Development with Unity Engine, Vuforia SDK, 3D Scanning Software and Photogrammetry

Block-II: Applications and Use Cases
- Real cases of companies that use digital twins
- Programming in Unity (C#)
- Functional Prototype Design

Block-III: Prototype Development and Manufacturing
- Real-time visualization and interaction of digital prototypes
- 3D Manufacturing of Physical Models
- Development and integration of multi-platform applications

TEACHING METHODOLOGIES
- Work sessions with the whole group, class with the teacher. (PA)
- Individual Autonomous Work (EP) Sessions

COMPETENCIES
- G2 - Configure new realities to interpret the historical, social, cultural, economic and technological context.
- CB2 - Students must know how to apply their knowledge to their work or vocation in a professional way and possess the competencies that are usually demonstrated through the elaboration and defence of arguments and the resolution of problems within their area of study
- CB4 - Students are able to transmit information, ideas, problems and solutions to both a specialised and non-specialised audience
- T2 - Project the values of entrepreneurship and innovation in the exercise of the personal, academic and professional trajectory, through contact with different realities of practice and with motivation towards professional development.

- T4 - Show skills for professional practice in multidisciplinary and complex environments, in coordination with networking teams, either in face-to-face or virtual environments, through the computer and informational use of ICT.
- T6 - Use different forms of communication, both oral and written or audiovisual, in their own language and in foreign languages, with a high degree of correctness in use, form and content.
- E3 - Use computer science and programming for application in different phases of industrial design engineering.
- E6 - Use different methodologies and work tools to correctly design any product, system or service.
- E7 - Develop prototypes for experimentation and formal and technical testing that allow the communication of the concept and technical justification of the project.
- E10 - Understand the current industrial reality in order to function in the professional environment.
- E11 - Identify emerging technologies that can add value to the project.

LEARNING OUTCOMES

- Apply their knowledge to solve problems in complex or professional and specialized work environments that require the use of creative and innovative ideas.
- It communicates knowledge, methodology, ideas, problems and solutions to all types of audiences (specialized or not) in a clear and precise way.
- Solves problems and situations typical of professional performance with entrepreneurial and innovative attitudes.
- It designs interventions that meet the needs of the field in a multidisciplinary way.
- It uses audiovisual language and its different resources to express and present content linked to specific knowledge of the field.
- Apply data in different phases of industrial design engineering.
- Use the necessary tools for the completion of products, systems and services.
- Communicates concepts by prototyping.
- Develops in the professional environment.
- Bring value to the project by identifying the right emerging technologies.

TRAINING ACTIVITIES

Each subject will present at the beginning of the course its WORK PLAN where the didactic activities per week / session / autonomous work are recorded.

EVALUATION

EVALUATION SYSTEMS

The evaluation of the subject will be based on continuous monitoring of the student's academic work throughout the course.

EVALUATION SYSTEM	FINAL WEIGHTING
P2-Follow-up of the work done	25
P3-Reports from the students themselves, external tutors, examining board	15
P5-Completion of required work or projects	60

EVALUATION CRITERIA

The final grade of the subject will be the weighted average of the grades of the assessable activities according to the following table:

ASSESSABLE ACTIVITY	WEIGHT	RETRIEVABLE (up to 50%)	EVALUATION SYSTEM
Activity-1 Attendance and Participation	10%	NO	P-2
Activity-2 Performing exercises	15%	YES*	P-3
Activity-3 Projects Partial delivery	20%	NO	P-5
Activity-4 Projects Final Delivery	40%	YES*	P-5
Activity-5 Individual Contributions to Projects	15%	NO	P-2

Students will have the option of retaking the retake tests. The retake tests will be carried out in the period of the semester allocated to this function, not being able to recover more than 50% of the subject.

* In the event that the Recoverable Assessable Activities exceed 50%, the student body may choose, up to a limit of 50%.

The unjustified non-submission of any assessable activity implies a grade of 0, even if the activity has been classified as Recoverable.

Recoverable Activities can only be recovered when they have been submitted by the student body on the indicated date and with a grade equal to or greater than 3.

If access to the retake test is waived, the grade achieved in the first instance will be maintained.

In case of taking the recovery, the grade obtained will be the last, even if it is lower than the first.

Plagiarism or copying someone else's work is penalised in all universities and, according to the Rules of Coexistence of the University of Vic-Central University of Catalonia, they constitute serious or very serious offences. That is why in the course of this subject any indication of plagiarism or misappropriation of texts or ideas of other people (What is considered plagiarism?) as well as the improper or undeclared use of Artificial Intelligence in an activity, automatically translates into a failure and/or other disciplinary measures (Normes de Convivencia de la Universitat de Vic-Universitat Central de Catalunya). For any questions or queries, see the (Academic Regulations of the Bachelor's Degree of the Faculty of Design and Engineering Elisava UVic-UCC).

BIBLIOGRAPHY AND TEACHING RESOURCES

- Linowes, J., & Babilinski, K. 2017. *Augmented Reality for Developers: Build practical augmented reality applications with Unity*. ARCore, ARKit, and Vuforia.
- Nath, S. V., Van Schalkwyk, P., & Isaacs, D. 2021. *Building Industrial Digital Twins: Design, develop, and deploy digital twin solutions for real-world industries using Azure Digital Twins.* Packt Publishing Ltd.
- Singh, M., Fuenmayor, E., Hinchy, E. P., Qiao, Y., Murray, N., & Devine, D. 2021. Digital twin: Origin to future. *Applied System Innovation,* 4(2), 36.
- Wijesooriya, I. *Mastering Augmented Reality Development with Unity: Subtitle. In Mastering Augmented Reality Development with Unity.* Mercury Learning and Information.

Facultat de Disseny i Enginyeria
ELISAVA