1. OVERVIEW

Subject Area	Workshop III: Digital Manufacturing and Parametric Design
Degree	Bachelor's Degree in Design
School/Faculty	Faculty of Architecture, Engineering and Design
Year	Second
ECTS	6 ECTS
Type	Compulsory
Language(s)	Spanish/English
Delivery Mode	On campus
Semester	Second semester
Academic Year	2024-2025
Coordinating professor	

2. INTRODUCTION

This subject deals with the use and practical implementation of different methods of rapid prototyping and digital production. Preparation of 3-D models for production. Possibilities, limits and the use for each technology: 3-D printing, laser cutting, CNC, etc.
Understanding of how advanced organic and parametric modelling tools can model and set parameters. Awareness of the techniques in geometry, complex modifiable curves and surfaces (attractor systems, panelisation, modifiers, etc.).

Introduction to Rhinoceros and Grasshopper. Modelling tools. Geometry. Curves, vectors and matrices. Attractor systems and panelisation. Scripting. Programming as a project tool. Automation. Using code to test multiple solutions. Introduction to processing - Python. Visual programming. Introduction to Arduino and its uses.

This subject is part of module 4 in the integration section. This module develops different projects over 7 compulsory workshop subjects. These projects integrate the skills involved in design and other similar and complementary areas using project-based learning methodology.

From the most basic knowledge of the materials that designers work with to the mastery of complex projects involving professionals from various disciplines, students will gradually learn about the complexities of a designer's work throughout these seven compulsory workshops.

3. SKILLS AND LEARNING OUTCOMES

Key skills (CB, by the acronym in Spanish):

- CB1: Students have shown their knowledge and understanding of a study area that builds on general secondary school education, and are usually at the level where, with the support of more advanced textbooks, they may also demonstrate awareness of the latest developments in their field of study.
- CB2: Students can apply their knowledge to their work or vocation in a professional manner and possess the skills which are usually evident through the forming and defending of opinions and resolving problems within their study area.
- CB3: Students have the ability to gather and interpret relevant data (usually within their study area) to form opinions which include reflecting on relevant social, scientific or ethical matters.
- CB4: Students can communicate information, ideas, problems and solutions to both specialist and non-specialist audiences.
- CB5: Students have developed the learning skills necessary to undertake further study in a much more independent manner.

Transversal skills (CT, as per the Spanish acronym):

- CT1: Independent Learning: the ability to choose the most effective strategies, tools and opportunities for independent learning and implementation of what they have learnt.
- CT 11: Planning and time management: ability to set objectives and choose the right means to fulfil them through efficient use of time and resources.
- CT13: Problem solving: ability to resolve an unclear or complex issue or situation which has no established solution and requires skill to reach a conclusion.
- CT14: Innovation/Creativity: ability to propose and invent new and original solutions broadening the scope and bringing different aspects to the original problem.
- CT 17: Teamwork: ability to integrate and collaborate actively with other people, areas and/or organisations to reach common goals.
- CT 18: Use of information and communication technology (ICT): ability to effectively use information and communication technology such as search tools, processing and storing information, as well as developing communication skills.

Specific skills (CE, as per the Spanish acronym):

- CE5. Ability to apply knowledge of physics, dimensioning, numerical calculus, analytical geometry and basic algebra in design projects.
- CE7. Understanding of theories of shape and composition to create designs to suit user needs and requirements, ensuring they respect the relationship between shape, function and the context in which they are used.
- CE11. Ability to apply the technology and tools of graphic design, product and interiors in the different design creation and production phases.
- CE18. Awareness of the principles of sustainability, preservation of energy, material and environmental resources and ability to apply them to the creation and development of product and interior design projects.

Learning outcomes (RA, as per the Spanish acronym):

- RA3: Use digital manufacturing techniques in design using the different rapid prototyping and digital production methods. Preparation of 3-D models for production. Possibilities, limits and the use for each technology: 3-D printing, laser cutting, CNC.
- RA10: Integrate the industrial production of the design project with other design areas such as engineering or architecture.
- RA12: Develop advanced projects in the project-based learning area with groups of students from different disciplines and in collaboration with students off architecture and engineering courses.

The following table shows how the skills developed in the subject area match up with the intended learning outcomes:

Skills	Learning outcomes
CB1, CB2, CB3, CB4, CB5 CT1, CT11, CT13, CE5, CE7, CE11, CE18	• RA3: Use digital manufacturing techniques in design using the different rapid prototyping and digital production methods. Preparation of 3-D models for production. Possibilities, limits and the use for each technology: 3-D printing, laser cutting, CNC.
CB1, CB2, CB3, CB4, CB5 CE5, CE7, CE11, CE18	• RA10: Integrate the industrial production of the design project with other design areas such as engineering or architecture.
CB1, CB2, CB3, CB4, CB5 CT17 CE5, CE7, CE11, CE18	• RA12: Develop advanced projects in the project-based learning area with groups of students from different disciplines and in collaboration with students off architecture and engineering courses.

4. CONTENTS

The subject matter is divided into six teaching units.

- Unit 1: Modelling
- Unit 2: Scanning Unit 3: Laser cutting
- Unit 4: 3-D printing
- Unit 5: CNC
- Unit 6: Project

The course concludes with a portfolio consisting of the course activities. The material is readjusted to provide graphical representation to the document. Students work on the portfolio as a reflection of their journey and experience.

5. TEACHING/LEARNING METHODS

The types of teaching/learning methods are as follows:

- Master lecture
- Collaborative learning.
- Project-based studies (PBS)
- Learning based on workshop teaching

6. LEARNING ACTIVITIES

The types of learning activities, plus the amount of time spent on each activity, are as follows:

On-campus:

Learning activity	Number of hours
Attendance and participation in activities	6.25h (on-site)
Directed learning, practical exercises and problem-solving	25h (20% on-site)
Project presentation	12.5h (on-site)
Integrated group project	12.5h (40% on-site)
Research work and projects	62.5h (40% on-site)
Self-study	12.5h (off-site)
Tutorials, academic follow-up and assessment	18.75h (on-site)
TOTAL	150 h

7. ASSESSMENT

The assessment methods, plus their weighting in the final grade for the course, are as follows:

On-campus:

Assessment method	Weight
Projects	100%

On the Virtual Campus, when you open the course, you can see all the details of your assessment activities and the deadlines and assessment procedures for each activity.

7.1. Ordinary examination period

To pass the course in the ordinary examination period you must obtain a grade of 5.0 or more out of 10.0 in the final grade (weighted average) for the subject.

No submissions will be accepted once the deadline has passed, unless it is a final submission where late work can be delivered due to justified reasons. Examples of justified reasons for late delivery are: illness with a doctor's note, work experience at a company with proof from that company, etc.

Plagiarism or copying will result in a 0 for that entire section of work. Missing more than 25% of classes will lead to an automatic fail in the ordinary examination period.

7.2. Extraordinary examination period

To pass the course in the extraordinary examination period you must obtain a grade of 5.0 or more out of 10.0 in the final grade (weighted average) for the subject.

Activities not passed in the ordinary examination period, or those not delivered, must now be delivered after having received the relevant corrections to them by the lecturer.

In addition, if students have attended less than 50% of classes, have completed less than 50% of the work to be submitted, or the lecturer has doubts about their work, they will be required to take a test.

8. SCHEDULE

The schedule with delivery dates of assessable activities in the course is indicated in this section:

Assessable activities	Date
Activity 1: Modelling	Week 1-3
Activity 2: Scanning	Week 3-4
Activity 3: Laser cutting	Week 5-7
Activity 4: 3-D printing	Week 8-10
Activity 5: CNC	Week 11 to 13
Activity 6: Project	Week 14 to 17

The schedule may be subject to modifications for logistical reasons of the activities. Students will be informed of any changes in due time and course.

9. BIBLIOGRAPHY

The recommended bibliography is indicated below:

- Neil GERSHENFELD, Fab: the coming revolution on your desktop - from personal computers to personal fabrication, Basic Books. Princeton Architectural Press, New York, 2005.
- Nuria ÁLVAREZ LOMBARDERO y Francisco GONZÁLEZ DE CANALES, Política y Fabricación Digital - una discusión en curso, Vibok Works, Sevilla, 2016.
- César GARCÍA SÁEZ, (Casi) todo por hacer. Una mirada social y educativa sobre los Fab Labs y el movimiento maker, Fundación Orange, España, 2016.
- Moritz HAUSCHILD & Rüdiger KARZEL, Digital Processes. Planing, design, production, Birkhäuser Detail Practice, 2011.
- Chris LEFTERI, Making it. Manufacturing Techniques for Product Design. Laurence King, Publishing, London, 2012.
- Arturo TEDESCHI, AAD_Algorithms-Aided Design. Parametric strategies using Grasshopper, Le Penseur Publisher, 2014.

10. EDUCATIONAL GUIDANCE AND DIVERSITY UNIT

The Educational Guidance and Diversity Unit offers support throughout your time at university to help you with your academic achievement. One of the main pillars of our educational policy is the inclusion of

students with special educational needs, universal accessibility to the different university campuses and equal opportunities.
This unit offers students:

1. Support and monitoring through personalised counselling and programmes for students who need to improve their academic performance.
2. Promotion of diversity, with curricular changes possible in terms of methodology or assessment for those students with special educational needs in order to provide equal opportunities for all our students.
3. We also offer students a range of educational extracurricular resources for developing a variety of skills to enhance their personal and professional development.
4. Career guidance by offering tools and advice to students with doubts regarding their professional careers or those who believe they have chosen the wrong line of study.

Students who need educational support can contact us at:
orientacioneducativa@universidadeuropea.es

11. SATISFACTION SURVEYS

Your opinion matters!

Universidad Europea encourages you to complete our satisfaction surveys to identify strengths and areas for improvement for staff, degree courses and the learning process.

These surveys will be available in the surveys area of your virtual campus or by email.

Your opinion is essential to improve the quality of the course.

Many thanks for taking part.