Universidad Zaragoza

**Academic Year/course: 2021/22**

# 62952 - 3D modelling with smart geometry

## Syllabus Information

**Academic Year:** 2021/22
**Subject:** 62952 - 3D modelling with smart geometry
**Faculty / School:** 110 - Escuela de Ingeniería y Arquitectura
**Degree:** 562 - Master's in Product Development Engineering
**ECTS:** 4.5
**Year:** 1
**Semester:** Second semester
**Subject Type:** Optional
**Module:**

# 1. General information

## 1.1. Aims of the course

- Complementary training for bachelor?s degree, with learning specialized 3D modeling techniques.
- Provide the student resources for immediate implementation in their working environment, professional or researcher.
- Strengthen its ability to create new, non-viable products through other systems.
- Encourage creativity.

- These approaches and objectives are aligned with some of the Sustainable Development Goals, SDGs, of the 2030 Schedule (https://www.un.org/sustainabledevelopment/en/) and certain specific goals, in such a way that the acquisition of the Learning outcomes of the subject provide training and competence to the student to contribute to a certain extent to their achievement:

  **Goal 9:** Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation. **Target: 9.4**: By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities **Goal 12:** Ensure sustainable consumption and production patterns. **Target 12.5:** By 2030,substantially reduce waste generation through prevention, reduction, recycling and reuse.

## 1.2. Context and importance of this course in the degree

This is a subject of 4.5 credits ECTs optional character (OPT) that fits in the second semester of the **Master's in Product Development Engineering.** Technologies that reviews can be linked with other subjects as, *"Comunicación y Presentación de Producto*" (OB) (62944), increasing the range of products to represent and improve the presentation of modeling jobs, especially when involving materials with properties complex or based on organic tissue mutations or optical. Acquired knowledge and skills are essential in the design of products such as splint by additive manufacturing so it is complementary to "*Diseño para fabricación aditiva*" (OPT) (62953).

## 1.3. Recommendations to take this course

The student must have academic knowledge (bachelor) in visual disciplines, graphic engineering or computer graphics, especially those related to conventional 3D development product techniques: Solid modeling, generation by surfaces or CAD (mechanical or architectural). It is also desirable to have basic training in matters related to the launch of new products.

# 2. Learning goals

## 2.1. Competences

- Ability to lead in bio-engineering projects.
- Ability to select and to use digital techniques to recreate anatomical or inspired by nature forms.

- Capacity to modify the topology of a mesh obtained by scanning so that it can be adapted to the needs of develop.
- Ability to obtain synergies and sustainable digital technologies. They are expanding their ability to adapt to complex or multidisciplinary projects.

### 2.2. Learning goals

The student, for passing this subject, should demonstrate the following results ...

- Capacity to model products with organic appearance or complex surfaces.
- Ability to design variants or morphological mutations products by generative algorithms or other graphic editing techniques.
- Ability to use advanced digital sculpting tools.
- Capacity to integrate all geometric information from CAD standards with the techniques learned in this subject.
- Ability  to optimize the 3D geometric mesh topology so that they can be used in subsequent processes such as, for example, manufacture of prototypes or using computer animation.

### 2.3. Importance of learning goals

Learning outcomes of this course are essential to model rigorously products inspired by nature or based on anatomical patterns.
The revised by matter techniques accelerate the launch cycle stages, reducing production costs. Its contents can be decisve for product development when working in reverse engineering processes or redesign components.

## 3. Assessment (1st and 2nd call)

### 3.1. Assessment tasks (description of tasks, marking system and assessment criteria)

The student must demonstrate that it has achieved the intended learning outcomes through the following evaluation activities:

**A OPTION : Continuous Assessment**

- REVIEW CASE STUDY RESOLVED BY TASK: Students must perform ~~FIVE~~ tasks are integrated in a particular case. These tasks determine the understanding of the subject and ability to apply learning and a subject chosen by him and supervised by teachers. They are individual. Account for 75% of the total score.
- EXHIBITION of project or CASE RESOLVED: Collects and adapts the above tasks for public exhibition in digital platform support on selected education (MOODLE). This phase allows pooling of individual initiative of each student. It is 25% of the grade.
- The total score is evaluated on 10 points. To approve it must obtain more than 5 note.

**B OPTION: Review/Final**

- For those students who want this option or not exceeding the minimum qualification in the form of continuous assessment (5/10), a written test that consign 100% of the qualification to hold within the established exam schedule will be made by the EINA.

## 4. Methodology, learning tasks, syllabus and resources

### 4.1. Methodological overview

It is a practical course based on innovative methodological foundations and rational academic resources. It focuses on the use of 3D geometric modeling tools appropriate to the level of a Master's student and oriented towards the study of complex or special cases. This favors the acquisition of initiative,visual creativity and analysis skills in projects related to production system and/or company. Class attendance and monitoring of the proposed activities are aspects that will help make better use of the course and as a result to the achievement of the learning objectives.

A wide range of teaching and learning tasks are implemented, such as individual assignments, dissemination of results, student participation and continuous work throughout the course, exercises and case studies, among others.

### 4.2. Learning tasks

The course includes the following learning tasks:

- LECTURES (20 hours). The professor explains to the whole student group the theoretical concepts of the course, which are illustrated with examples for a better understanding. Students are encouraged to participate and discuss.
- PRACTICE SESSIONS (7 hours). They are taught in small groups if the number of students is high. In these classes the contents of the lectures are reviewed with the help of problems and case studies.
- COMPUTER PRACTICE SESSIONS (18 hours, distributed in 6 session of three hours each). They are organized so that students learn to handle different tools for product presentation. The goal is to get the student able to interpret the results and question their validity.
- AUTONOMOUS WORK (60 hours). The series of problems and tasks, which are similar to those made in class, the students must solve independently.
- TUTORIALS (7.5 hours). The student is helped to solve the doubts raised during the learning process. These hours also include the presentation and evaluation of assignments submitted to the virtual platform Moodle.

## 4.3. Syllabus

The course will address the following topics:

1. 3D Modeling techniques of polygon meshes. Geometry and redesign of objects under construction considerations using polygons. Smoothing algorithms and subdivision surfaces. Organic topologies and strategies for optimizing meshes of varying resolutión.
2. UV mapping methods for detail optimizing.
3. Techniques and Tools digital sculpture with high-density polygon meshes.
4. Retopology 3D models methods. Systems reducing the number of polygons to digitized objects. Decimation parameters.
5. Special modeling systems based on polygon meshes: Modeling humans parameters. Biological form based generators.
6. Generative Design by parameters. Iterated polygonal systems for industrial product designg.

## 4.4. Course planning and calendar

The tasks must be submitted in the agreed dates with the students, when it is more compatible with their other courses. Deadlines must be communicated in advance.

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course, will be provided on the first day of class or please refer to the EINA website and the Moodle website.

In the official academic calendar they are reflected class periods and dates Deadline for submission of assignments. The theoretical and practical classes, as well as places to teach them are reflected in the schedules of the website of the EINA ( EINA.unizar.es).
Relevant information will be communicated to students through the platform MOODLE teaching assistance that will support organizational and teamwork environment.

## 4.5. Bibliography and recommended resources

~~ADDITIONAL RESOURCES.~~

- ~~Several authors. "3D WORLD Magazine". Pages 100 approx. Monthly magazine. Years 2017-2019. Editor. Future Publishing LTD Co. ISSN. 1470-4382.~~
- ~~Several authors. "IMAGINE FX Magazine". Pages 100 approx. Monthly magazine. Years 2017-2019. Editor. Future Publishing LTD Co. ISSN. 1748-930X.~~

The practical resources, digital samples and open source tools will be provided or informed to the students via MOODLE.