Universidad de Navarra

Prototipos (Ing.Gr.)
Guía docente 2026-27

PRESENTACIÓN

Breve descripción:

IN ENGLISH

The Prototyping course focuses on the conceptualization, development, and creation of physical and virtual models within the product design process. Throughout the course, students explore various prototyping techniques, 3D modeling, and materials to validate both the formal definition and functionality of their designs. The highly practical approach of the subject enables students to experiment with prototyping tools/materials, empowering them to communicate complex ideas tridimensionally and optimize decision-making during industrial product development.

IN SPANISH

La asignatura de Prototipos se centra en la conceptualización, desarrollo y materialización de modelos físicos y virtuales aplicados al proceso de diseño de productos. A lo largo del curso, los estudiantes exploran diversas técnicas de prototipado, modelado 3D y uso de materiales para validar tanto la definición formal como la funcionalidad de sus propuestas. El enfoque eminentemente práctico de la materia permite experimentar con herramientas/materiales de prototipado, capacitando a los estudiantes para comunicar ideas complejas de forma tridimensional y optimizar la toma de decisiones en el desarrollo industrial.

Titulación (Módulo/Materia):

- Ingeniería en Diseño industrial y Desarrollo de productos (Diseño Industrial/Diseño Avanzado)

Detalles:

- **ECTS**: 4 ECTS
- **Curso, semestre**: 3.º curso, 1.º semestre
- **Carácter**: Obligatorio
- **Idioma**: English

Profesores de la asignatura:

- Cazón Martín, Aitor/Profesor titular
- Candal Pazos, Maria Virginia/Invitado
- Matey Muñoz, Luis Mariano/Profesor Colaborador
- Ordoñez Talavera, Iñigo/Colaborador Docente

RESULTADOS DE APRENDIZAJE (Competencias)

INGENIERÍA EN DISEÑO INDUSTRIAL Y DESARROLLO DE PRODUCTOS

CG4 - Adquirir la habilidad de fabricar prototipos del producto mediante diferentes técnicas, ya sean de índole técnico como el prototipado rápido o de índole manual como maquetas o la utilización de la fotografía.

CE26 - Conocimientos para el Desarrollo de nuevos productos mediante herramientas informáticas de diseño y validación, respetando su integración medioambiental y una adecuada ergonomía.

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CE27 - Conocimiento de la tecnología de los materiales y de las técnicas de producción apropiadas para la fabricación de prototipos y su producción en serie. Capacidad para elaborar la documentación técnica necesaria para la ejecución del proyecto.

PROGRAM

IN ENGLISH

1 Prototypes in the product design process

- Traditional and Concurrent Engineering
- Definition: What, when and why of prototyping?
- Similarity: Geometric, Kinematic and Dynamic
- Prototype fidelity

2 Mock-ups

- Foam boards
- Corrugated board
- Rigid foams
- Modeling clay

3 Prototypes

- Virtual prototypes
- Reverse Engineering
- Additive Manufacturing

4 Master prototypes and pre-series

- What and why?
- Pilot and Zero series
- Plastic injection moulding

IN SPANISH

1 Prototipos en el proceso de diseño de producto

- Ingenieria tradicional frente a Ingeniería concurrente
- Definición: Qué, cuándo y por qué son necesarios los prototipos?
- Similaridad: Geométrica, cinemática y dinámica
- Fidelidad del prototipo

2 Maquetas

- Cartón pluma
- Cartón corrugado
- Espumás rígidas
- Arcilla

3 Prototipos

- Prototipos virtuales
- Ingeniería inversa

- Fabricación Aditiva

4 Prototipos máster y pre-series

- Qué y por qué?
- Series piloto y series cero.
- Moldeo por inyección de plásticos.

EDUCATIONAL ACTIVITIES

The dedication to the course will be around 100-120 hours (4 ECTS) divided in the following learning activities:

- Theoretical sessions: 20 hours
- Laboratory sessions: 20 hours
- Assignments: 30 hours
- Tutorship: 2 hours
- Personal work: 40 hours
- Final exam: 2 hours

TEACHING METHODOLOGIES

- Theoretical sessions
- Laboratory sessions
- Team work
- Doubt sessions
- Final exam

The classes will be divided into:

- Theoretical classes to explain the necessary knowledges to carry out the practical assignments
- Practical classes in which the students will develop their prototypes based on the concepts explained in the theoretical classes

Throughout the different sessions, students will:

- Draw several conceptual sketches with the free-hand techniques
- Create product briefings
  - Develop various mock-ups with different raw materials: rigid foam, clay, etc.
  - Develop various high fidelity prototypes with different technologies: 3D printing, injection moulding

Additionally, the students will have individual and group works (both at home) that will be evaluated.

It is recommended to have a basic knowledge of modeling with solids and surfaces techiques in PTC CREO CAD software application. Some of the course assignments will be based on this knowledge.

Finally, there will be a final exam to evaluate the knowledge acquired.

ASSESSMENT

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ORDINARY CALL

The final mark will be calculated as the sum of several assignments throughout the course and the final exam.

The assignments will be the following for a total of 6 points.

- A01. Rigid Foam PUR (0.7 p)
- A02. Foamboard (0.7 p)
- A03. Corrugated board (0.6 p)
- A04. Clay (0.5 p)
- A05. Reverse Engineering (0.25 p)
- A06. Virtual Prototyping (0.5p)
- A07. Additive Manufacturing (0.25 p)
- A08. Design for Additive Manufacturing (0.5 p)
- A09. MiniProject (1 p)
- A10. Injection (1 p)

The final exam will be in December 2026 (4 points).

To pass the course, the following is mandatory:

- A minimum of 5 points summing the marks of the assignments and the final exam.
- A minimum of 1.5 points out of 4 points in the final exam.

EXTRAORDINARY CALL

In case a student fails the course, (s)he will make again the failed assignments and (s)he will mandatory do a new final exam.

In case a student passes the course but wants to improve his/her mark:

- (S)he can make again the target assignments. In this case, the mark of the assignments from the ordinary call will no longer be valid.
- (S)he can do a new final exam. In this case, the mark of the exam of the ordinary call will no longer be valid.

To pass the course, the following is mandatory:

- A minimum of 5 points summing the marks of the assignments and the final exam.
- A minimum of 1.5 points out of 4 points in the final exam.

PLAGIARISM

In all demonstrable cases, the student will fail the entire course and not just the plagiarized assignment or exam. The final grade will be FAIL (0 our of 10)

OFFICE HOURS

Send an email to the professor to set an appointment.

- **Dr. Aitor Cazón** (acazon@unav.es). Office IG-104. Building Igara. Floor -1
- **Dr. Luis Matey** (lmatey@ceit.es). Building CEIT.

- **Dra. María Virginia Candal (mcandalpazo@external.unav.es)**.

BIBLIOGRAPHY AND RESOURCES

Coursebook:

- "A course on prototypes for engineers V5.0". Author: Aitor Cazón and Luis Matey

Recommended readings:

- "Integrated product and process design and development." Authors: Edward B. Magrab, Satyandra K. Gupta F. Patrick McCluskey Peter Sandborn. Publisher: Taylor & Francis. ISBN: 978-1-4200-7060-6. Localízalo en la biblioteca
- "Model-Making: Materials and Methods". Author: David Neat. Publisher: Crowood Press. ISBN-13: 978-1847970176. Localízalo en la biblioteca
- "Prototyping for Designers: Developing the Best Digital and Physical Products". : Author: Kathryn McElroy. Publisher: O'Reilly Media . ISBN: 978-1491954089. Localízalo en la biblioteca
- "Prototyping and Model making for Product Design". (2nd edition). Author: Bjarki Hallgrimsson. Publisher: Laurence King Publishing . ISBN: 978-1786275110. Localízalo en la biblioteca , formato papel Formato electrónico
- "The Maker's field guide".(5th edition). Author: Christopher Arsmstrong. ISBN: 978-1-7325455-3-3 Localízalo en la biblioteca