

Course guide

340095 - PRFA - Manufacturing Processes

Last modified: 19/05/2026

Unit in charge:	Vilanova i la Geltrú School of Engineering	
Teaching unit:	702 - CEM - Department of Materials Science and Engineering.	
Degree:	BACHELOR'S DEGREE IN INDUSTRIAL DESIGN AND PRODUCT DEVELOPMENT ENGINEERING (Syllabus 2009). (Compulsory subject).	
Academic year: 2026	ECTS Credits: 6.0	Languages: Catalan, Spanish

LECTURER

Coordinating lecturer:	SERGI MENARGUES MUÑOZ
Others:	Primer quadrimestre: ÀLEX LÁZARO GONZÁLEZ - D5021, D5022 OSCAR MARTÍN RAYA - D5011, D5012 SERGI MENARGUES MUÑOZ - D5011, D5012, D5021, D5022 TEODORO MUNIATEGUI PUIG - D5111, D5112, D5121

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

1. D50. Knowledge of basic fabrication processes to transform metals, POLIMEROS and ceramics.
2. D51. Ability to identify used machines and its parameters to control in each process.
3. D52. Ability to select, design and optimize more suitable fabrication processes up to design, material, use of the piece and environmental impact.
4. D53. Ability to associate possibilities to design in each fabrication process.

Transversal:

5. SELF-DIRECTED LEARNING - Level 2: Completing set tasks based on the guidelines set by lecturers. Devoting the time needed to complete each task, including personal contributions and expanding on the recommended information sources.
6. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 2. Using strategies for preparing and giving oral presentations. Writing texts and documents whose content is coherent, well structured and free of spelling and grammatical errors.
7. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.

TEACHING METHODOLOGY

- Attending sessions of exposition of contents.
- Attending sessions of practical work (resolution of exercises).
- Attending sessions of practical work in working groups (practices of laboratory).

The professor will introduce the theoretic bases of the matter of the manufacturing processes in the sessions of exposition of contents.

The professor will guide the student in the understanding of the theoretic concepts in the sessions of resolution of exercises, likewise, the oral communication by means of the presentation will be worked up and resolution in public of the proposed problems.

The ability of work in team will develop in the sessions of laboratory.

In the out-class activities the professor supervises the student's work by means of the analysis of his evolution through the evaluation activity and the guided activities.

LEARNING OBJECTIVES OF THE SUBJECT

(ENG)

1. To describe the basics of manufacturing processes for the transformation of metals, polymers and ceramic.
2. To know the dimensional and superficial metrology's basics and its relation in validation and verification of the different processes of manufacture.
3. To identify the utilized machinery and parameters to control the different processes.
4. To select, to design and to optimize the best-suited manufacturing processes in terms of the design, material, use of the part and environmental impact.
5. To correlate the designing possibilities to each manufacturing process.
6. Knowing and designing the management of quality of processes and products.
7. Learning the knowledge about physical properties that they allow defining him the specifications.
8. Applying the methodology of selection of materials and its processes.

STUDY LOAD

Type	Hours	Percentage
Hours small group	15,0	10.00
Self study	90,0	60.00
Hours large group	45,0	30.00

Total learning time: 150 h

CONTENTS

1: Metrology and quality in manufacturing processes

Description:

1.1 The metrology and measurement systems. Uncertainties of measurement. Systems of management of measures. 1.2. Product design and process selection.

Related activities:

Activity 1: informative class

Activity 2: Content's exercises1

Activity 3: Product and Process Controls practical

Activity 12: Partial exam 1.

Activity 25: Final exam.

Related competencies :

. D50. Knowledge of basic fabrication processes to transform metals, POLIMEROS and ceramics.

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07 AAT N2. SELF-DIRECTED LEARNING - Level 2: Completing set tasks based on the guidelines set by lecturers. Devoting the time needed to complete each task, including personal contributions and expanding on the recommended information sources.

04 COE N2. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 2. Using strategies for preparing and giving oral presentations. Writing texts and documents whose content is coherent, well structured and free of spelling and grammatical errors.

05 TEQ N2. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.

Full-or-part-time: 13h

Theory classes: 4h

Laboratory classes: 2h

Guided activities: 0h 30m

Self study : 6h 30m

2: Solidification and casting processes

Description:

2.1. Solidification mechanism. 2.2. Casting materials. 2.3. Design of products for manufacturing: shaping castings design and mould design. 2.4. Major casting techniques. 2.5. High pressure die casting 2.6. Semisolid processes.

Related activities:

Activity 4: informative class

Activity 5: Content' 2 exercises

Activity 6: Aluminium casting practice

Activity 7: Solidification microstructures practice

Activity 12: Partial exam 1.

Activity 25: Final exam.

Related competencies :

. D50. Knowledge of basic fabrication processes to transform metals, POLIMEROS and ceramics.

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05 TEQ N2. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.

Full-or-part-time: 19h

Theory classes: 5h

Laboratory classes: 3h

Guided activities: 0h 30m

Self study : 10h 30m

3: Joining processes

Description:

- 3.1 Joining processes: welding
- 3.2. Metallurgical phenomena: metals' weldability.
- 3.3. Welding processes.
- 3.4. Adhesives and fasteners

Related activities:

- (ENG) Activity 8: informative class
- Activity 9: Content' 3 exercises
- Activity 10: Welding practice
- Activity 11: Joining microstructures practice
- Activity 12: Partial exam 1
- Activity 25: Final exam

Related competencies :

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 - . D51. Ability to identify used machines and its parameters to control in each process.
 - . D52. Ability to select, design and optimize more suitable fabrication processes up to design, material, use of the piece and environmental impact.
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- 04 COE N2. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 2. Using strategies for preparing and giving oral presentations. Writing texts and documents whose content is coherent, well structured and free of spelling and grammatical errors.
- 05 TEQ N2. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.

Full-or-part-time: 25h

- Theory classes: 7h
- Laboratory classes: 3h
- Guided activities: 0h 30m
- Self study : 14h 30m

4: Forming processes

Description:

4.1. The origin, nature and utilisation of plastic flow. 4.2. Temperatures and Processes. Materials formability. 4.3. Rolling. Extrusion. Forging. Bending. Drawing. Superplastic forming.

Related activities:

(ENG) Activity 13: informative class

Activity 14: Content' 4 exercises

Activity 15: Sheet forming practice

Activity 24: Partial exam 2

Activity 25: Final exam

Related competencies :

. D50. Knowledge of basic fabrication processes to transform metals, POLIMEROS and ceramics.

. D51. Ability to identify used machines and its parameters to control in each process.

. D52. Ability to select, design and optimize more suitable fabrication processes up to design, material, use of the piece and environmental impact.

. D53. Ability to associate possibilities to design in each fabrication process.

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04 COE N2. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 2. Using strategies for preparing and giving oral presentations. Writing texts and documents whose content is coherent, well structured and free of spelling and grammatical errors.

05 TEQ N2. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.

Full-or-part-time: 24h

Theory classes: 8h

Laboratory classes: 2h

Guided activities: 0h 40m

Self study : 13h 20m

5: Machining processes

Description:

5.1. Shaping by means of chip removal. 5.2. Machinability. 5.3. Nontraditional machining processes. 5.4. Computer-aided manufacturing.

Related activities:

(ENG) Activity 16: informative class

Activity 17: Content' 5 exercises

Activity 18: CNC programming practice

Activity 24: Partial exam 2

Activity 25: Final exam

Related competencies :

. D50. Knowledge of basic fabrication processes to transform metals, POLIMEROS and ceramics.

. D51. Ability to identify used machines and its parameters to control in each process.

. D52. Ability to select, design and optimize more suitable fabrication processes up to design, material, use of the piece and environmental impact.

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Full-or-part-time: 13h

Theory classes: 3h 30m

Laboratory classes: 2h

Guided activities: 0h 30m

Self study : 7h

6: Powder metallurgy and Surface processes

Description:

6.1 Powder metallurgy: Design Consideration. 6.2 Surface engineering.

Related activities:

(ENG) Activity 149: informative class

Activity 20: Content' 6 exercises

Activity 24: Partial exam 2

Activity 25: Final exam

Related competencies :

. D50. Knowledge of basic fabrication processes to transform metals, POLIMEROS and ceramics.

. D51. Ability to identify used machines and its parameters to control in each process.

. D52. Ability to select, design and optimize more suitable fabrication processes up to design, material, use of the piece and environmental impact.

. D53. Ability to associate possibilities to design in each fabrication process.

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Full-or-part-time: 11h

Theory classes: 6h

Guided activities: 0h 30m

Self study : 4h 30m

7: Processing of plastics and composites

Description:

- 7.1. Injection Moulding.
- 7.2. Extrusion.
- 7.3. Blow Moulding.
- 7.4. Compression.
- 7.5. Thermoforming.
- 7.6. Manufacturing of composites materials

Related activities:

- (ENG) Activity 21: informative class
- Activity 22: Content' 7 exercises
- Activity 23: Electroplating on plastic practice
- Activity 24: Partial exam 2
- Activity 25: Final exam

Related competencies :

- . D50. Knowledge of basic fabrication processes to transform metals, POLIMEROS and ceramics.
- . D51. Ability to identify used machines and its parameters to control in each process.
- . D52. Ability to select, design and optimize more suitable fabrication processes up to design, material, use of the piece and environmental impact.
- . D53. Ability to associate possibilities to design in each fabrication process.
- 07 AAT N2. SELF-DIRECTED LEARNING - Level 2: Completing set tasks based on the guidelines set by lecturers. Devoting the time needed to complete each task, including personal contributions and expanding on the recommended information sources.
- 04 COE N2. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 2. Using strategies for preparing and giving oral presentations. Writing texts and documents whose content is coherent, well structured and free of spelling and grammatical errors.
- 05 TEQ N2. TEAMWORK - Level 2. Contributing to the consolidation of a team by planning targets and working efficiently to favor communication, task assignment and cohesion.

Full-or-part-time: 24h

- Theory classes: 6h 30m
- Laboratory classes: 2h
- Guided activities: 0h 45m
- Self study : 14h 45m

8: Additive manufacturing

Description:

Applications. Techniques

Specific objectives:

To know the different technologies of Additive Manufacturing

Related competencies :

- . D51. Ability to identify used machines and its parameters to control in each process.

Full-or-part-time: 1h

- Theory classes: 1h

GRADING SYSTEM

Individual written tests (T): 70%. There will be one partial exam (EP1) and a final exam (EF)

Report on laboratory practices (L): 20%

Presentation and evaluation of proposed problems (individual or in-group): 10%

The evaluation of the course will be based on the following indicators:

If $EP1 > 5$, then, in EF the student only take the second part of the subject

If $EP2 > EP1$: $NF = 70\% EP2 + 20\% L + 10\% Q$

If $EP2 < EP1$: $NF = 40\% EP2 + 30\% EP1 + 20\% L + 10\% Q$

- If $EP1 < 5$: $NF = 70\% EF + 20\% L + 10\% Q$

The completion and presentation of the corresponding reports of at least 75% of the laboratory practices will be a necessary condition to passing the subject. Otherwise, the maximum grade for the subject will be failing grade, with a 4.9 (UPC., Academic Regulations for Bachelor's and Master's Degrees)

The laboratory practices, the tests carried out via Campus Digital and the activities carried out in the classroom during the regular period of classes (problems and / or presentations of work) will not be re-evaluated. Only the part of (T) is considered re-evaluable.

EXAMINATION RULES.

All the planned activities in this subject have a part in which the students have to attend in person and another part in which the students have to do an independent learning. Before the classes of problems, the students will individually discuss individually or in small groups the proposed problems and will have to present their solution. The evaluation of this task will influence in the evaluation. For the practical exercises in the laboratory, the students have to previously know the fundamentals of each test and knowledge that results are expected for each test. A pre-test may be required to access the laboratory for certain practices.

The accomplishment of the individual tests will be carried out in accordance with the course timetable.

BIBLIOGRAPHY

Basic:

- Kalpakjian, Serop; Schmid, Steven R. Manufacturing engineering and technology. 8th ed. Harlow: Pearson Education Limited, 2023. ISBN 9781292422244.

- Groover, Mikell P. Fundamentals of modern manufacturing : materials, processes, and systems, SI version [on line]. 7th ed. New York: John Wiley & Sons, Incorporated, 2021 [Consultation: 19/03/2024]. Available on: https://search-ebscohost-com.recursos.biblioteca.upc.edu/login.aspx?direct=true&AuthType=ip,uid&db=nlebk&AN=3756146&site=ehost-live&ebv=EB&ppid=pp_C1. ISBN 9781119767022.

- Ashby, Mike; Johnson, Kara. Materials and design : the art and science of material selection in product design [on line]. 3rd ed. Amsterdam: Elsevier Butterworth-Heinemann, 2014 [Consultation: 20/02/2024]. Available on: <https://www.sciencedirect-com.recursos.biblioteca.upc.edu/book/9781856174978/materials-and-design>. ISBN 9780080982052.

- Youssef, Helmi A.; El-Hofy, Hassan A.; Ahmed, Mahmoud H. Manufacturing technology : materials, processes and equipment [on line]. 2nd ed. Boca Raton, FL: CRC Press, 2023 [Consultation: 20/02/2024]. Available on: <https://www-taylorfrancis-com.recursos.biblioteca.upc.edu/books/mono/10.1201/9781003373209/manufacturing-technology-helmi-youssef-mahmoud-ahmed-hassan-el-hofy>. ISBN 9781003373209.

- El Wakil, Sherif D. Processes and design for manufacturing. 3rd ed. Boca Raton, FL: CRC Press, 2019. ISBN 9781138581081.

Complementary:

- Lesko, Jim. Industrial design materials and manufacturing guide [on line]. New York: John Wiley & Sons, 2008 [Consultation: 14/02/2024]. Available on: <https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=818988>. ISBN 9780470055380.

- Seider, Warren D. Product and process design principles : synthesis, analysis, and evaluation [on line]. 4th ed. Hoboken, NJ: John Wiley & Sons, 2017 [Consultation: 21/03/2024]. Available on: https://search-ebscohost-com.recursos.biblioteca.upc.edu/login.aspx?direct=true&AuthType=ip,uid&db=nlebk&AN=1639416&site=ehost-live&ebv=EB&ppid=pp_C1. ISBN 9781119588009.

- Singh, Mrityunjay; Ohji, Tatsuki; Asthana, Rajiv. Green and sustainable manufacturing of advanced material [on line]. Amsterdam, Netherlands: Elsevier Science, 2016 [Consultation: 20/02/2024]. Available on: <https://www.sciencedirect-com.recursos.biblioteca.upc.edu/book/9780124114975/green-and-sustainable-manufacturing-of-advanced-material>. ISBN 0-12-411526-8.

- Gupta, Kapil. Advanced manufacturing technologies : modern machining, advanced joining, sustainable manufacturing [on line]. Cham, Switzerland: Springer, 2017 [Consultation: 13/02/2024]. Available on: <https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=4851844>. ISBN 9783319560991.
- Li, Wen. Efficiency of Manufacturing Processes [electronic resource] : Energy and Ecological Perspectives [on line]. Cham: Springer International Publishing, 2015 [Consultation: 23/11/2023]. Available on: <https://link.springer.com/book/10.1007/978-3-319-17365-8>. ISBN 3319173650.

RESOURCES

Hyperlink:

- http://www.mit.tut.fi/dictionary/Dic_FrameSet.html. Multilingual dictionary of basic and general terms in metrology
- <http://www.efunda.com/home.cfm>. Online Reference for Engineers
- http://www.sme.org/cgi-bin/getsmepg.pl?communities/education/edu_community_hp.htm&&&SME&. Manufacturing Education & Research Community
- <http://iate.europa.eu/iatediff/switchLang.do?success=mainPage&lang=es>. IATE, Inter-Active Terminology for Europe, is the EU inter-institutional terminology database.