

340201 - MPAF-M7P02 - Advanced Manufacturing Materials and Processes

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| Coordinating unit: | 340 - EPSEVG - Vilanova i la Geltrú School of Engineering |
| Teaching unit: | 702 - CMEM - Department of Materials Science and Metallurgy |
| Academic year: | 2018 |
| Degree: | BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Teaching unit Optional) BACHELOR'S DEGREE IN INDUSTRIAL DESIGN AND PRODUCT DEVELOPMENT ENGINEERING (Syllabus 2009). (Teaching unit Optional) |
| ECTS credits: | 6 |
| Teaching languages: | Catalan, Spanish, English |

Teaching staff

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| Coordinator: | SERGI MENARGUES MUÑOZ |
| Others: | SERGI MENARGUES MUÑOZ |

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.

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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

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| Total learning time: 150h | Hours large group: | 45h | 30.00% |
| | Hours medium group: | 0h | 0.00% |
| | Hours small group: | 15h | 10.00% |
| | Guided activities: | 0h | 0.00% |
| | Self study: | 90h | 60.00% |

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Content

1: Metrology and quality in manufacturing processes

Learning time: 13h

Theory classes: 4h
Laboratory classes: 2h
Guided activities: 0h 30m
Self study : 6h 30m

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.

2: Solidification and casting processes

Learning time: 20h

Theory classes: 6h
Practical classes: 0h
Laboratory classes: 3h
Guided activities: 0h 30m
Self study : 10h 30m

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.

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| <p>3: Joining processes</p> | <p>Learning time: 25h</p> <p>Theory classes: 7h Practical classes: 0h Laboratory classes: 3h Guided activities: 0h 30m Self study : 14h 30m</p> |
| <p>Description:</p> <p>3.1 Joining processes: welding 3.2. Metallurgical phenomena: metals' weldability. 3.3. Welding processes. 3.4. Adhesives and fasteners</p> <p>Related activities:</p> <p>(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</p> | |
| <p>4: Forming processes</p> | <p>Learning time: 24h</p> <p>Theory classes: 8h Practical classes: 0h Laboratory classes: 2h Guided activities: 0h 40m Self study : 13h 20m</p> |
| <p>Description:</p> <p>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.</p> <p>Related activities:</p> <p>(ENG) Activity 13: informative class Activity 14: Content' 4 exercises Activity 15: Sheet forming practice Activity 24: Partial exam 2 Activity 25: Final exam</p> | |

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| <p>5: Machining processes</p> | <p>Learning time: 13h</p> <p>Theory classes: 3h 30m Practical classes: 0h Laboratory classes: 2h Guided activities: 0h 30m Self study : 7h</p> |
| <p>Description: 5.1. Shaping by means of chip removal. 5.2. Machinability. 5.3. Nontraditional machining processes. 5.4. Computer-aided manufacturing.</p> <p>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</p> | |
| <p>6: Powder metallurgy and Surface processes</p> | <p>Learning time: 11h</p> <p>Theory classes: 6h Practical classes: 0h Guided activities: 0h 30m Self study : 4h 30m</p> |
| <p>Description: 6.1 Powder metallurgy: Design Consideration. 6.2 Surface engineering.</p> <p>Related activities: (ENG) Activity 149: informative class Activity 20: Content' 6 exercises Activity 24: Partial exam 2 Activity 25: Final exam</p> | |

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| <p>7: Processing of plastics and composites materials</p> | <p>Learning time: 24h Theory classes: 6h 30m Practical classes: 0h Laboratory classes: 2h Guided activities: 0h 45m Self study : 14h 45m</p> |
| <p>Description: 7.1. Injection Moulding. 7.2. Extrusion. 7.3. Blow Moulding. 7.4. Compression. 7.5. Thermoforming. 7.6. Manufacturing of composites materials.</p> <p>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</p> | |

Qualification system

The evaluation of the course will become according to the following indicators:

- T, Theory: average mid-term exam 1 and mid-term exam 2.
- P, Solves exercises: Average of the different made exercises.
- L, Practices of laboratory: Weighted average of the different programmed practices.
- F, Final Exam.

The grade of the course will be obtained applying the most favourable one of the following scale:

1. Final grade = $0,6T+0,1P+0,3L$

2. Final grade = $0,6F+0,1P+0,3L$

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.

The completion and presentation of the corresponding reports of at least 75% of the laboratory practices will be a necessary condition for the approval of the subject. It will also be a necessary condition to have participated in, at least, 75% of the presentations made in the classroom and to have made the evaluations of them.

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Bibliography

Basic:

Lesko, Jim. Diseño industrial : guía de materiales y procesos de manufactura. México: Limusa Noriega, 2004. ISBN 968185957X.

Groover, Mikell P. Fundamentals of modern manufacturing : materials, processes, and systems. 2010. New York: Wiley, 2013. ISBN 9780470467008.

Kalpakjian, Serope; Schmid, Steven R. Manufacturing processes for engineering materials. 5th ed. Upper Saddle River: Pearson Education, 2008. ISBN 9789810679538.

Ashby, M. F.; Johnson, Kara. Materials and design : the art and science of material selection in product design [on line]. 2nd ed. Amsterdam [etc.]: Butterworth-Heinemann, 2010 [Consultation: 08/10/2014]. Available on: <<http://www.sciencedirect.com/science/book/9781856174978>>. ISBN 9781856174978.

Youssef, Helmi A. Manufacturing technology : materials, processes and equipment. Boca Raton: CRC Press, 2012. ISBN 9781439810859.

Complementary:

Lesko, Jim. Industrial design materials and manufacturing. 2nd ed. New York: Wiley, 2004. ISBN 9780470055380.

ASM handbook. Vol. 14, Forming and forging. 9th ed. Metals Park, Ohio: American Society for Metals, 1988. ISBN 9780871700209.

Seider, Warren D.; Seader, J.D.; Lewin, Daniel R.; Widagdo, Soemantri. Product and process design principles : synthesis, analysis, and evaluation. 3rd ed. Hoboken: John Wiley & Sons, 2010. ISBN 9780470414415.

Others 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.