Course guide
330520 - FAOCAM - Computer-Aided Manufacturing (Cam)

Last modified: 04/05/2023

Unit in charge:	Manresa School of Engineering
Teaching unit:	712 - EM - Department of Mechanical Engineering.

Degree:	BACHELOR'S DEGREE IN AUTOMOTIVE ENGINEERING (Syllabus 2017). (Compulsory subject).

Academic year: 2023   **ECTS Credits:** 3.0   **Languages:** Catalan, Spanish

LECTURER

Coordinating lecturer:	Alcelay Larrión, José Ignacio
Others:	Martínez Fitó, Xavier
	Al Omar Mesnaoui, Anas
	Peña Pitarch, Esteban
	Martínez Fitó, Xavier

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. (ENG) Ha de ser capaç de realitzar programes de control numèric (CNC) per a torn.
2. Must be able to perform numerical control (CNC) programs for machining center.
3. (ENG) Ha de ser capaç de interpretar, corregir i optimizar programes de control numèric (CNC).

Transversal:
4. 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.
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.

TEACHING METHODOLOGY

MD1 Master class or conference (EXP)
MD2 Problem solving and case study (RP)
MD4 Directed theoretical practical work (TD)
MD5 Project, activity, or reduced work (PR)
MD7 Project or broad work (PA)
MD8 Company visit and/or specialized workshops (VI)

The subject will be developed in theoretical and practical classes, complemented with tutorials, problem solving, debates, communications, etc. The theoretical classes will be carried out in an expository-participatory way and complemented by abundant exercises for the theoretical settlement, accompanied by programming manuals in English. The practical classes will be articulated by means of practical application problems carried out with the participation of the students in the classroom, and with sessions of workshops and laboratories where the realization of practical and very participatory activities has been programmed.

For each session, the student will be provided, with sufficient anticipation in the virtual classroom, the notes of the topic covered in the session, and a series of problems.
- Carrying out laboratory practices in small groups. Elaboration of reports.
- Solving and delivering problems proposed individually.
- Tutoring, study, personal work, and teamwork.
- Exams and assessment tests.

LEARNING OBJECTIVES OF THE SUBJECT

OCAM01: Acquire and integrate knowledge about the manufacturing processes of a product OCAM02: Develop the ability to select and design the most appropriate manufacturing process or processes in each case.
OCAM03: Learn and know the assisted manufacturing techniques (CAM).
OCAM04: Use and understand manufacturing and / or prototyping techniques.
OCAM05: Use and capture the flow and operation of CAD-CAM tools aimed at the manufacture of complex parts such as moulds and dies.

STUDY LOAD

Type	Hours	Percentage
Self study	45,0	60.00
Hours small group	30,0	40.00

Total learning time: 75 h

CONTENTS

Introduction to Manufacturing processes

Description:
General manufacturing processes: chip removal, filing, scraping, turning, drilling, reaming, milling, abrasive machining, sawing, filing, gear manufacturing. Metrology, verification: tolerances, adjustments, roughness, measuring instruments, measurement errors. Joining and cutting process: resistance welding, oxyacetylene welding, arc welding, oxycutting. Other transformation processes: EDM, laser, water jet, ...

Specific objectives:
OCAM01, OCAM02

Related activities:
CRO1, CRO2, PRA

Full-or-part-time: 12h
Practical classes: 12h

CNC

Description:
Differences between conventional MHC and MH with CNC. Flexible automation. Classification of CNC systems. Structure of the MHCN and Architecture of the CNC. Activations. Control. Sensors. Axes and Reference Systems. Basic principles. Programming languages. Structure of a Numerical Control program. Reference systems. ISO coding. Trajectory control. Parametric programming.

Specific objectives:
OCAM03, OCAM04, OCAM05

Related activities:
PRA

Full-or-part-time: 14h
Practical classes: 4h
Self study : 10h

Advanced CNC

Description:
Dimension scheduling. Linear movements and auxiliary functions. Circular movements, circular interpolations. Tool compensation. Additional preparatory functions. Program control statements. Fixed cycles and subprograms. Operations with parameters.

Specific objectives:
OCAM03, OCAM04, OCAM05

Related activities:
PRA

Full-or-part-time: 14h
Practical classes: 4h
Self study : 10h

CAD-CAM

Description:
Manufacturing systems. Flexible: features, elements, calculation control, selection.

Specific objectives:
OCAM03, OCAM04, OCAM05

Related activities:
PRA,PRO

Full-or-part-time: 20h
Practical classes: 10h
Self study : 10h

ACTIVITIES

Monographic works and presentations (TMP)

Description:
Development and defense of a topic proposed by the teacher related to the subject. This is a non-contact task to be carried out as a team.

Specific objectives:
OCAM01, OCAM02

Material:
Notes, web and library

Delivery:
In the digital campus "ATENEA" and oral defense

Full-or-part-time: 23h
Practical classes: 8h
Self study: 15h

CAD-CAM Practical work (PR)

Description:
Given several pieces, it will be necessary to elaborate CNC program in each case.

Specific objectives:
OCAM03, OCAM04, OCAM05

Material:
Measurement and drawing tools

Delivery:
Paper

Full-or-part-time: 18h
Practical classes: 18h

: Individual Test (PI)

Description:
Individual test of the subject where the student, individually, will have to demonstrate the knowledge acquired during the course.

Specific objectives:
OCAM01, OCAM02, OCAM03, OCAM04, OCAM05

Material:
Computer, paper

Delivery:
Test resolution

Full-or-part-time: 2h
Practical classes: 2h

: Final Exam (PF)

Description:
Final test of the subject where the student, individually, will have to demonstrate the knowledge acquired during the course.

Specific objectives:
OCAM01, OCAM02, OCAM03, OCAM04, OCAM05

Material:
Computer, paper

Delivery:
Test resolution

Full-or-part-time: 2h
Practical classes: 2h

GRADING SYSTEM

Continuous evaluation of student work.

The study and autonomous work of the student is evaluated, both in-person and non-face-to-face, applied to all the formative activities.

The subject is passed by continuous assessment if an overall grade of >4.95 is obtained by taking the weighted average of:

- TMP: 25% of the note of the course.
- PR: 35% of the note of the course.
- PI: 40% of the note of the course.

Students who fail to pass the subject by continuous assessment will have to go to the final recovery test.

EXAMINATION RULES.

The practical work with a computer must be submitted using the ATENEA application in the condition they are in at the end of the session.

BIBLIOGRAPHY

Basic:

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- Groover, Mikell P. Fundamentos de manufactura moderna: materiales, procesos y sistemas [on line]. 3ª ed. México: McGraw-Hill, 2007 [Consultation: 12/11/2020]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?docID=4585363. ISBN 9789701062401.

- Chang, Tien-Chien; Wysk, Richard A.; Wang, Hsu-Pin. Computer-aided manufacturing. 3rd ed. Upper Saddle River: Prentice Hall, 2006. ISBN 0131429191.

- Kalpakjian, Serope; Schmid, Steven R. Manufactura, ingeniería y tecnología [on line]. 7ª ed. México: Pearson, 2014 [Consultation: 03/06/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=5323. ISBN 9786073227353 (V. 1), 9786073227421 (V. 2).

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Complementary:

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- Micheletti, Gian Federico. Mecanizado por arranque de viruta: tecnología mecánica. Barcelona: Blume, 1980. ISBN 847002502.

- Ostwald, Phillip F.; Muñoz, Jairo. Manufacturing processes and systems. 9th ed. New York: John Wiley & Sons, 1997. ISBN 0471047414.

- Creese, Robert C. Introduction to manufacturing processes and materials. New York: Marcel Dekker, 1999. ISBN 0824799143.

- Schey, John A. Introduction to manufacturing processes. 3rd ed. Boston: McGraw-Hill, 2000. ISBN 0070311366.

- Alting, Leo. Procesos para ingeniería de manufactura. México: Alfaomega, 1989. ISBN 9686223002.