



Universidad de Jaén

School of Engineering of Jaén

Integrated manufacturing systems

2024-2025

Máster Universitario en Ingeniería industrial (E.P.S. Jaén)

Doble Máster Ingeniería Industrial y Administración de Empresas (E.P.S. Jaén)



CREA



Acceso Mayores 40

Guías docentes UJA

Horarios de tutorías

Llamamientos PAU

Movilidad (Coordinador)

P.O.D.

Solicitud bilingüismo

Syllabus 2024-25 - 74712002 - Integrated Manufacturing Systems (Sistemas integrados de fabricación)

Caption

- Level 1: Tutorial support sessions, materials and exams in this language
- Level 2: Tutorial support sessions, materials, exams and seminars in this language
- Level 3: Tutorial support sessions, materials, exams, seminars and regular lectures in this language

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DEGREE:

Máster en Ingeniería industrial (74712002)

FACULTY:

SCHOOL OF ENGINEERING OF JAÉN

DEGREE:

Doble Máster en Ingeniería industrial y Administración de empresas (MBA) (79312013)

FACULTY:

SCHOOL OF ENGINEERING OF JAÉN

ACADEMIC YEAR:

2024-25

COURSE:

Integrated Manufacturing Systems

SYLLABUS

1. COURSE BASIC INFORMATION

NAME: Integrated Manufacturing Systems

CODE: 74712002 (*)

ACADEMIC YEAR: 2024-25

LANGUAGE: English

LEVEL: 1

ECTS CREDITS: 5.0

YEAR: 2

SEMESTER: PC

2. LECTURER BASIC INFORMATION

NAME: DORADO VICENTE, RUBÉN

DEPARTMENT: U121 - INGENIERÍA MECÁNICA Y MINERA

FIELD OF STUDY: 515 - INGENIERIA DE LOS PROCESOS DE FABRICACIÓN

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LANGUAGE: English

LEVEL: 1

3. CONTENT DESCRIPTION

Topic 1. Introduction to Integrated Manufacturing Systems.

- *Introduction* : Definitions, description of the driving technologies of industry 4.0 and its importance in the integration of manufacturing systems, production systems, automation and manual work.
- *Manufacturing systems* : Types of industries. Types of processes. Organization of processes. Basic parameters.

Topic 2. Design for DFM manufacturing.

- *Introduction to DFM* : Advantages and disadvantages. Approaches for decision making: Hierarchical Analytical Process.
- *Concurrent engineering* : Prioritization, rationalization and other strategies. Composition of concurrent teams. Types of organization.
- *DFM Guides* : Design oriented to the maintenance and safety of products and processes. Development of sustainable products. Design rules for components. Design rules for products: metrics to quantify the assembly time.

Topic 3. Computer Integrated Manufacturing CIM

- *Introduction to the CIM* : Definition, Objectives, Components, Models. Computer Aided Design and Manufacturing.
- *Introduction to production automation of production.*
- *PLCs, Numerical Control and Industrial Robots.*

Topic 4. Additive manufacturing

- *Main processes and technologies, materials, additive manufacturing stages, variables to consider (cost, quality, standardization, functionality), Design for Additive Manufacturing (Appearance, resistance, utility), process planning (Requirements of form, division and printing of multiple objects, orientation, supports, lamination, Program of instructions), current challenges.*

Topic 5. Manufacturing planning and control

- *Metrics and cost in manufacturing processes.*
- *Automatic Maintenance Systems.*
- *Flexible manufacturing systems.* Group theory, analysis of flexible manufacturing systems.
- *Quality assurance.* Customer error, producer error, monitoring technologies (Metrology, inspection techniques with and without contact).

Practical Contents:

Lab 1. Design for manufacturing and assembly.

Session 1. Concurrent engineering : Steps for the redesign of products based on concurrent engineering.

Session 2. Implementation of design guides in CAD software: application to injection molding.

Lab 2. CAE-CAM software.

Session 3. CAE analysis of life cycle focus on manufacturing.

Session 4. Numerical CAE analysis: topological optimization for additive manufacturing.

Session 5. Use of CAM software to obtain G code from a 3D model.

Lab 3. Fast manufacturing of a plastic part

Session 6. Introduction to using Additive Manufacturing machines and 3D scanners

Session 7. Planning the manufacturing and the experimental setting.

Session 8. Manufacturing a part.

Session 9. Inspection and testing.

Lab 4. Analysis of flexible integrated systems.

Session 10. Introduction to the simulation of discrete events.

Activities: Exercises and project

Series of exercises on the contents of each topic.

Redesign of a product based on manufacturing, and rapid manufacturing based on integration. Manufacturing-oriented development project: Concurrent development (multidisciplinary team design), engineering, manufacturing planning and production of a prototype. Conceptual development to be done as a team throughout the semester, actual manufacturing during Lab 3.

4. COURSE DESCRIPTION AND TEACHING METHODOLOGY

A1. Large group sessions:

M1 Theoretical lectures. This is the presentation of the theoretical concepts of the subject. Competencies to develop: CB8R, CE02, CG02 and CT02. Learning outcomes: 2.1, 2.2 and 2.4.

M2 Exposition of theory and general examples. A discussion of the theoretical concepts is carried out and illustrative example cases are presented. Competencies to develop: CB7R, CE02 and CG02. Learning outcomes: 2.2, 2.3 and 2.4.

M5 Concurrent product development project. Group work to develop and manufacture a product following the philosophy of design for manufacturing. An introductory session is held and then each group works autonomously during the semester guided by the professors of the subject. Competencies to develop: CB7R, CB8R, CE02, CG02, CT01 and CT02. Learning outcomes: 2.2, 2.3 and 2.4

A2R. Individual and small group sessions:

M9MR Practical activities in laboratories or computer rooms. Through these activities, the student applies the knowledge of the subject to practical cases. Competencies to develop: CB7R, CB8R, CE02, CG02, CT01 and CT02. Learning outcomes: 2.2, 2.3 and 2.4.

M10MR Resolution of exercises. In this case, the application of the knowledge of the subject to solve problems is also intended. Competencies to develop: CB7R, CB8R, CE02, CG02, and CT02. Learning outcomes: 2.1, 2.2, 2.3 and 2.4.

M11MR Presentation. Students will present some of the works proposed in the practical activities. Competencies to develop: CB8R, CT01, CT02. Learning outcome: 2.2.

Students with special educational needs should contact the Student Attention Service (Servicio de Atención y Ayudas al Estudiante) in order to receive the appropriate academic support

5. ASSESSMENT METHODOLOGY

Mark = $0.05 \cdot S1_1 + 0.05 \cdot S1_2 + 0.6 \cdot S2 + 0.15 \cdot S3 + 0.15 \cdot S4$.

Mark obtained in practices (S4), attendance (S1_1), participation (S1_2) and for carrying out a project (S3) will ONLY be added to the exam grade (S2) if the exam grade is GREATER OR EQUAL TO 5.

Attendance at laboratory practices and the presentation of a report on the practical work carried out in the laboratory is mandatory in order to pass the subject.

Evaluation tools.

Attendance S1_1 . Attendance will be taken into account.

Participation S1_2 . It will be evaluated through deliveries or exercises and with them the competences will be evaluated: CB7R, CB8R, CE02, CG02, and CT02, and the learning outcomes: 2.1, 2.2, 2.3 and 2.4.

S2 exam . It allows to evaluate the knowledge acquired at the end of the course. Competencies to be evaluated: CB7R, CB8R, CE02, CG02, CT01 and CT02. Learning outcomes: 2.1, 2.2, 2.3 and 2.4

Realization of redesign project S3 . It is about continuously evaluating whether the learning results are being achieved. The weekly project progress reports, the final project report and a descriptive video of the developed product will be used as evaluation tools. With the concurrent development project, the competences will be evaluated: CB7R, CB8R, CE02, CG02, CT01 and CT02, and the learning outcomes: 2.2, 2.3 and 2.4.

Practices S4 . In this case, the practical application of the learning outcomes to real specific cases is continuously evaluated. Therefore, the competences considered in the subject are trained and evaluated. Some of the practices are carried out with specific software to assist manufacturing processes (CB7R, CB8R, CE02, CG02). In others, group work is carried out to train multidisciplinary and multicultural teamwork (in the case of having Erasmus students enrolled) facing a product development and manufacturing project (CB7R, CB8R, CE02, CG02, CT01 and CT02). Learning outcomes: 2.1, 2.2, 2.3 and 2.4.

6. BOOKLIST ([Access the bibliography in the Library catalog](#))

MAIN BOOKLIST:

- Automation, production systems, and computer integrated manufacturing. Edition: 3rd ed., Pearson new international ed.. Author: Groover, Mikell P., 1939-. Publisher: Harlow : Pearson, 2014 ([Library](#))
- Design for manufacturability : how to use concurrent engineering to rapidly develop low-cost, high-q. Edition: -. Author: Anderson, David M.. Publisher: Boca Raton : CRC, cop. 2014 ([Library](#))
- Computer integrated manufacturing and engineering. Edition: 1st ed., 7th repr.. Author: Rembold, Ulrich. Publisher: Harlow [etc.] : Prentice Hall, 2004 ([Library](#))
- Manufacturing Systems Modeling and Analysis [electronic resource] by Guy L. Curry, Richard M. Feldman.. Edition: 1st ed. 2009.. Author: Curry, Guy L. author.. Publisher: Springer Berlin Heidelberg ([Library](#))

ADDITIONAL BOOKLIST:

- CAD/CAM/CIM. Edition: -. Author: Radhakrishnan, P. Subramanyan, S. Raju, V.. Publisher: New Age International ([Library](#))
- Fundamentals of Digital Manufacturing Science [Recurso electrónico] . Edition: -. Author: Zhou, Zude.. Publisher: London : Springer London, 2012 ([Library](#))

7. SUSTAINABLE DEVELOPMENT GOALS

Industria, innovación e infraestructura

Producción y consumo responsables

DETAILED INFORMATION

Goal 9. Industry, innovation and infrastructure.

The subject can contribute to these targets:

9.2 Promote inclusive and sustainable industrialization. This course promotes ideas for the industrial transformation via scientific knowledge and concurrent engineering.

9.4 Retrofit industries to make them sustainable. Flexible manufacturing systems and additive manufacturing can contribute to improve the sustainability of current industries.

9.c Increase access to information and communications technology. Manufacturing integration is based on information technologies and communications.

Objetivo 12. Responsible consumption and production.

The subject can contribute to these targets:

12.5 Reduce waste generation. Life Cycle Analysis (LCA) can make aware people about waste (material and energy) generation.

12.8 Ensure that people everywhere have the relevant information and awareness for sustainable development. LCA will also contribute in this target.

8. VIRTUAL / CLASSROOM TEACHING SCENARIO

1. Methodology and learning activities

Learning activities	Face to Face / online	Methodology Skills: CB7R, CB8R, CG02, CE02, CT02, CT01
30 Theoretical sessions about the subject	Face to face 100% (*)	30 theoretical sessions by video conference. -Case face to face 100%: conventional methodology. -Case face to face < 100%. Face to face students: conventional methodology, online students: online methodology.
10 Practical sessions	Face to face 100% (*)	10 (grouped in 6 issues) online practical sessions. -Case face to face 100%: conventional methodology. -Case face to face <100%. Face to face students: conventional methodology, online students: online methodology.
4 Problems and exercises	Online (*)	Four multimedia files with problems and exercises to resolve by the students. Solutions should be submitted to the educational platform.
Tutorial sessions	Face to face 100% (*)	Tutorial sessions at the trainers' timetable. -Case face to face 100%: conventional methodology. -Case face to face < 100%. Face to face students: conventional methodology, online students: online tutorial sessions.

(*) The Center may establish a different attendance percentage depending on the number of students and capacity of the classroom / laboratory.

For the online activities, the professors involved in teaching are reserved the right not to consent for the capture, publication, retransmission or reproduction of his speech, image, voice, and explanations, in the exercise of its teaching functions, within the scope of the University of Jaén.

2. Evaluation system**Regular**

Evaluation tool	Face to Face / online	Description	Percentage
S1 Attendance and participation	Face to face 100%	-Case face to face 100%: conventional evaluation. -Case face to face < 100%. Face to face students: conventional evaluation, online students: Exercises (5%), and attendance to the online learning activities (5%)	10%
S2 Exam	Face to face 100%	Exam: Questions-problems	60 %
S3 Exercises and works	Online Asynchronous	Student submissions	15 %
S4 Practical sessions reports	Online Asynchronous	Student submissions	15 %

Extraordinary call

Evaluation tool	Face to Face / online	Description	Percentage
S1 Attendance and participation	Face to face 100%	-Case face to face 100%: conventional evaluation. -Case face to face < 100%. Face to face students: conventional evaluation, online students: Exercises (5%), and attendance to the online learning activities (5%)	10 %
S2 Exam	Face to face 100%	Exam: Questions-problems	60 %

S3 Exercises and works	Online Asynchronous	Student submissions	15 %
S4 Practical sessions reports	Online Asynchronous	Student submissions	15 %

3. Resources

Type	Goal	Description
Social networks	Information management	Educational platform. Google meets. e-mail.
Software	Lab simulations	Virtualized software. Licensed Engineering Software: Fusion, Catia, Abaqus, and Mathematica. Open source software such as Ultimaker Cura and netlogo. Internet connection
Books	Engineering contents in electronic format	Several books used in the subject are available in electronic format at the UJA library

9. VIRTUAL TEACHING SCENARIO

1. Methodology and learning activities

Learning activities	Face to Face / online	Methodology
		Skills: CB7R, CB8R, CG02, CE02, CT02, CT01
30 Theoretical sessions about the subject	Online (*)	30 theoretical sessions by video conference.
10 Practical sessions	Online (*)	10 (grouped in 6 issues) online practical sessions. Issues 2 - 4 and 6: Guidance via google meets, and practical tasks via engineering software virtualized. Issue 1 about concurrent engineering. By means of google meets. Issue 5 about 3D printing and 3D scanning. The available machines can be controlled via web.
4 Problems and exercises	Online (*)	Four multimedia files with problems and exercises to resolve by the students. Solutions should be submitted to the educational platform.
Tutorial sessions	Online (*)	On line tutorial sessions at the trainers' timetable according to the educational platform reservation Sheet.

(*) In the online scenario, the professors involved in teaching are reserved the right not to consent for the capture, publication, retransmission or reproduction of his speech, image, voice, and explanations, in the exercise of its teaching functions, within the scope of the University of Jaén.

2. Evaluation system

Regular call

Evaluation tool	Face to Face / online	Description	Percentage
S1 Attendance and participation	Online Synchronous	Exercises (5%), and attendance to the online learning activities (5%)	10%
S2 Exam	Online Synchronous	Exam: Questions-problems in the educational platform + Identification via meet	60 %

S3 Exercises and works	Online Asynchronous	Student submissions	15 %
S4 Practical sessions reports	Online Asynchronous	Student submissions	15 %

Extra call

Evaluation tool	Face to Face / online	Description	Percentage
S1 Attendance and participation	Online Synchronous	Exercises (5%), and attendance to the online learning activities (5%)	10%
S2 Exam	Online Synchronous	Exam: Questions-problems in the educational platform + Identification via meet	60 %
S3 Exercises and works	Online Asynchronous	Student submissions	15 %
S4 Practical sessions reports	Online Asynchronous	Student submissions	15 %

For those students without a grade in the S1, S3 and S4 activities the final grade will be the exam grade.

3. Resources

Type	Goal	Description
Social networks	Information management	Educational platform. Google meets. e-mail.
Software	Lab simulations	Virtualized software. Licensed Engineering Software: Fusion, Catia, Abaqus, and Mathematica. Open source software such as Ultimaker Cura and netlogo. Internet connection
Books	Engineering contents in electronic format	Several books used in the subject are available in electronic format at the UJA library

DATA PROTECTION CLAUSE (on line exams)

Institution in charge of data processing: Universidad de Jaén, Campus Las Lagunillas, s/n, 23071 Jaén

Data Protection Delegate: dpo@ujaen.es

Purpose: In accordance with the Universities Law and other national and regional regulations in force, carrying out exams and assessment tests corresponding to the courses students are registered in. In order to avoid frauds while sitting the exam, the exam will be answered using a videoconference system, being able the academic staff of the University of Jaén to compare and contrast the image of the person who is answering the exam with the student's photographic files. Likewise, in order to provide the exam with evidential content for revisions or claims, in accordance with current regulation frameworks, the exam will be recorded and stored.

Legitimacy: compliance with legal obligations (Universities Law) and other national and regional regulations currently in force.

Addressees: service providers who are the owners of the platforms where the exams are carried out and with whom the University of Jaén has signed the corresponding data access contracts.

Storage periods: those established in current in force regulations. In the specific case of exam videoconference recordings, not before the examination records and transcripts are closed or the exam can still be reviewed or challenged.

Rights: you can exercise your right of access, amendment, cancellation, opposition, suppression, limitation and portability by sending a letter to the postal or electronic address indicated above. In the

event that you consider that your rights have been violated, you may submit a complaint to the Andalusian Council for Transparency and Data Protection www.ctpdandalucia.es

CLASS RECORDING CLAUSE PERSONAL DATA PROTECTION

Person in charge: Universidad de Jaén, Paraje Las Lagunillas, s/n; Tel.953 212121; www.ujaen.es

Data protection delegate (DPO): TELEFÓNICA, S.A.U. ; Email: dpo@ujaen.es

Procedure aim: To manage proper recordings of teaching sessions with the aim of facilitating learning process under a multimodal and/or online teaching

Period for record storage: Images will be kept during legal term according to regulations in force

Legitimacy: Data will be managed according to legal regulations (Organic Law 6/2001, December 21, on Universities) and given consent provided by selecting corresponding box in legal admission documents

Data recipients (transfers or assignments): Any person allowed to get access to every teaching modality

Rights: You may exercise your rights of access, rectification, cancellation, portability, limitation of processing, deletion or, where appropriate, opposition. To exercise these rights, you must submit a written request to the Information, Registration and Electronic Administration Service of the University of Jaen at the address above, or by e-mail to the address above. You must specify which of these rights you are requesting to be satisfied and, at the same time, you must attach a photocopy of your ID card or equivalent identification document. In case you act through a representative, legal or voluntary, you must also provide a document that proves this representation and identification. Likewise, if you consider that your right to personal data protection has been violated, you may file a complaint with the Andalusian Data Protection and Transparency Council www.ctpdandalucia.es

Campus Las Lagunillas s/n | 23071 - Jaén

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