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## Syllabus 2023-24 - 14613008 - Advanced Methods of Mechanical Design (Métodos avanzados de diseño mecánico)

### 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: Grado en Ingeniería mecánica (14613008)  
 FACULTY: SCHOOL OF ENGINEERING OF LINARES  
 DEGREE: Doble grado en Ingeniería eléctrica e Ingeniería mecánica (14813011)  
 FACULTY: SCHOOL OF ENGINEERING OF LINARES  
 ACADEMIC YEAR: 2023-24  
 COURSE: Advanced Methods of Mechanical Design

### SYLLABUS

#### 1. COURSE BASIC INFORMATION

NAME: Advanced Methods of Mechanical Design  
 CODE: 14613008 (\*) ACADEMIC YEAR: 2023-24  
 LANGUAGE: English LEVEL: 0  
 ECTS CREDITS: 6.0 YEAR: 4 SEMESTER: PC

#### 2. LECTURER BASIC INFORMATION

NAME: MOLINA VIEDMA, ÁNGEL JESUS  
 DEPARTMENT: U121 - INGENIERÍA MECÁNICA Y MINERA  
 FIELD OF STUDY: 545 - INGENIERÍA MECÁNICA  
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 WEBSITE: -  
 ORCID: -  
 LANGUAGE: - LEVEL: 1

#### 3. CONTENT DESCRIPTION

Lesson 1. Fundamentals of computer aided engineering.

Lesson 2. Fundamentals of the Finite Element Method.

Lesson 3. Variational formulation of the truss element.

Lesson 4. Variational formulation of the beam element.

Lesson 5. Variational formulation of the plane element.

Lesson 6. Isoparametric formulation of the plane element.

Lesson 7. Formulation of plate and Shell elements.

Lesson 8. Formulation of the tridimensional element.

Practice 1. Analysis using truss elements.

Práctica 2. Analysis using beam elements.

Práctica 3. Analysis using plane and tridimensional elements.

Práctica 4. Analysis of non-linearities.

Práctica 5. Analysis of contact.

Práctica 6. Modal analysis.

#### 4. COURSE DESCRIPTION AND TEACHING METHODOLOGY

Master classes (M1 - Lectures, M2 - Theory and general examples and M3 - Introductory activities and problem solving). The basic concepts of the subject will be presented through multimedia presentations, theoretical expositions, and realization of examples. With a total of 45 hours and an autonomous work by the student is estimated of 67.5 hours. In these classes will develop the specific competences CEM2, CEM4 and CEM9 as well as the general CB2, CB3, CB5 and CT2 and the results 16 and 17.

Practices (M11 - Resolution of exercises, M9 - Laboratories and M8 Participation and debates). This course, given its applied mechanics focus, has many contents that will be explored through activities that involve the practical application of knowledge. A total of 10.0 hours will be applied and an autonomous work by the student is estimated at 15.0 hours. In these classes the specific competences CEM2, and CEM9, the general ones CT4 CT2 CT6 CB4 and CB5 and the results 18 and 19 will be developed for which the student must deliver the works that are set. In particular, a series of practice work and a final project will be carried out in which the students will develop a specific engineering project.

Collective tutorials (M17 - Clarification of doubts). This activity is organized in short seminars where problems will deepen in some of the topics studied in the lectures, and will also resolve doubts of the students. This is intended to strengthen the competences CEM2 and CT2

Seminars (M15 - Seminars). A seminar will be organized on topics related to the context in which the subject is developed. This is intended to strengthen the CEM2 and CT2 competences

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

The grading system will be governed by the provisions of RD 1125/2003 of September 5, which establishes the European credit system and the grading system for official university degrees.

For the evaluation of the subject, an exam will be carried out as a fundamental evaluation procedure (60% of the final grade of the subject) to evaluate the results Resul-16 and Resul-17.

In order to reduce the weight of the exam, other evaluation criteria have been taken into account, such as attendance and participation in class (5%), laboratory practice reports (20%) and delivery and presentation of a final work for the subject which will have a weight of 15%. In these sections, the learning of the specific CB2, CB3, CB4, CB5, CEM2, CEM4 and CT4 competencies and results 18 and 19 are mainly evaluated. For this, the PLATEA platform will serve as a support instrument, issuing reports, either individualized (in the personal area of each student) or group.

Regarding the exam, it is necessary for the student to acquire a minimum score of 4 points out of ten to pass the course. Attendance at the practices and the delivery in time of the reports of practices and work are mandatory. In addition, it is necessary to obtain a minimum score of 3 out of 10 in each of the practical reports and 5 on the job. Failure to comply with any of these conditions implies not being able to pass the subject in any call of the course.

The student could request an evaluation through a single test, in which the weight of the exam would be 100% of the grade for the subject, only under the exceptional circumstances that are included in article 13 of the Academic Regulations and of Evaluation of the Alumnado of the University of Jaén.

The request, accompanied by the due justification, can only be made during the teaching period of the subject.

#### 6. BOOKLIST

##### MAIN BOOKLIST:

- El método de los elementos finitos. Edition: 6ª ed.. Author: Zienkiewicz, O. C.. Publisher: Barcelona : Centro Internacional de Métodos Numéricos en Ingeniería, 2010 ([Library](#))
- Cálculo de estructuras por el método de elementos finitos: análisis elástico lineal. Edition: [1ª ed.]. Author: Oñate Ibáñez de Navarra, Eugenio. Publisher: Barcelona: Centro Internacional de Métodos Numéricos en Ingeniería, 1992 ([Library](#))
- A first course in the finite element method. Edition: 5th ed.. Author: Logan, Daryl L.. Publisher: Stamford : Cengage Learning, 2012 ([Library](#))
- El método de los elementos finitos aplicado al análisis estructural. Edition: 2ª ed. Author: Vázquez Fernández, Manuel. Publisher: Madrid : Noela, 2013 ([Library](#))
- Introduction to the finite element method J. N. Reddy. Edition: 4th. ed.. Author: Reddy, J.N.. Publisher: - ([Library](#))

##### ADDITIONAL BOOKLIST:

- Finite elements in fracture mechanics: Theory--Numerics--Applications. Edition: -. Author: Kuna, M. (Meinhard). Publisher: Dordrecht ; New York : Springer, c2013 ([Library](#))
- Structural Analysis with the Finite Element Method. Linear Statics [electronic resource] : Volume 1: Basis and Solids by Eugenio Oñate.. Edition: 1st ed. 2009.. Author: Oñate, Eugenio. author.. Publisher: Springer Netherlands ([Library](#))
- Structural Analysis with the Finite Element Method. Linear Statics [electronic resource] : Volume 2: Beams, Plates and Shells by Eugenio Oñate.. Edition: 1st ed. 2013.. Author: Oñate, Eugenio. author.. Publisher: Springer Netherlands ([Library](#))

#### 7. VIRTUAL / CLASSROOM TEACHING SCENARIO

##### TEACHING METHODOLOGY AND FORMATIVE ACTIVITIES

Activities formatives	Format	Methodology
30 Theory Sessions on Program Contents	In-person 100% (*)	Class to all the students of the group in the assigned time and classroom.  30 synchronous master classes, one or two hours each, held in the classroom.
Practical activities and seminars	In-person 100% (*)	Class to all the students of the group in the assigned time and classroom.  10 hour-long practice sessions synchronously.
Tutorials	In-person + Online	Some tutoring sessions will be held in-person and others online, always synchronously, except in some cases.

(\*) The Center may establish rotating attendance depending on the number of students and the capacity of the classroom / laboratory (class in the schedule and classroom / laboratory assigned to a part of the group and broadcast by videoconference to the rest, with periodic rotation of students, as determined by the Center).

#### **ASSESSMENT METHODOLOGY**

The assessment methodology for the subject under this modality is combination of continuous evaluation through works and practices, and a final exam. The subject is approved as a whole in all the calls, so the weights and conditions of the different parts remain unchanged.

Assessment type	Format	Description	Weight
Attendance and active participation in class	Presence + online	Attendance and participation	5%
Continuous assessment of theoretical concepts	Presence + Online	Realization of theoretical tests	25%
Continuous assessment of applied concepts	Presence + Online	Realization of proposed exercises	35%
Practices	Online	Assistance and realization of reports. Both aspects are mandatory. It is necessary to obtain a minimum grade of 3 points out of 10 in each report.	20%
Works	Online	Mandatory submission of a job. It is necessary to obtain a minimum score of 5 out of 10.	15%

The evaluation methodology for the subject under this modality is continuous. The subject is approved as a whole in all the calls, so the weights and conditions of the different parts remain unchanged.

In the event that no qualification greater than 5 during the course, the student may access a written in-person examination, provided that the conditions of capacity allow it, in the corresponding call. In it, the theoretical and applied contents are evaluated, with the same weight as during the continuous evaluation, 60%, keeping the weights of the rest of items to complete 100%.

The student may request a single test evaluation, in which the weight of the exam would be 100% of the grade of the subject, only under the exceptional circumstances set out in article 13 of the Reglamento de Régimen Académico y de Evaluación del Alumnado de la Universidad de Jaén . The application, accompanied by due justification, can only be made during the teaching period of the subject.

## **RESOURCES**

For the adaptation of teaching and evaluation to the online mode, the tools enabled by the University of Jaén will be used for this purpose: Google Meet, Google Jamboard, Google Forms, ILIAS platform, etc.

In particular, for practices and the work, finite element software for mechanical calculation will be used, which can be accessed through free-access computer rooms, virtual pcs or through free student licenses available for installation on their pcs.

In addition, for both exams and presentation of jobs or exercises in which it is applicable, it is necessary that the student has a webcam and microphone as means of interaction and identification against fraud.

## **8. VIRTUAL TEACHING SCENARIO**

### **TEACHING METHODOLOGY AND FORMATIVE ACTIVITIES**

<b>Formative activities</b>	<b>Format</b>	<b>Teaching methodology. Description</b>
30 Theory Sessions on Program Contents	Online	30 synchronous master classes, one or two hours each, broadcasted by videoconference synchronously
10 Practice sessions in the computer classroom	Online	10 hour-long practice sessions broadcasted by videoconference synchronously or replaced by videos asynchronously.
Tutorials	Online	Some tutoring sessions will be online, always synchronously, except in some cases.

### **ASSESSMENT METHODOLOGY**

The evaluation methodology for the subject under this modality is continuous. The subject is approved as a whole in all the calls, so the weights and conditions of the different parts remain unchanged. In view of the eventuality of moving towards this completely non-face-to-face modality, these criteria are maintained with respect to the mixed modality with the aim of not altering the conditions of evaluation of the students.

<b>Assessment type</b>	<b>Format</b>	<b>Description</b>	<b>Weight</b>
Attendance and active participation of class	Online	Attendance and participation	5%
Continuous assessment of theoretical concepts	Online	Realization of theoretical tests	25%
Continuous assessment of applied concepts	Online	Realization of proposed exercises	35%

Practices	Online	Assistance and realization of reports. Both aspects are mandatory. It is necessary to obtain a minimum grade of 3 points out of 10 in each report.	20%
Works	Online	Mandatory submission of a job. It is necessary to obtain a minimum score of 5 out of 10.	15%

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### **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](http://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](http://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](http://www.ctpdandalucia.es)

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