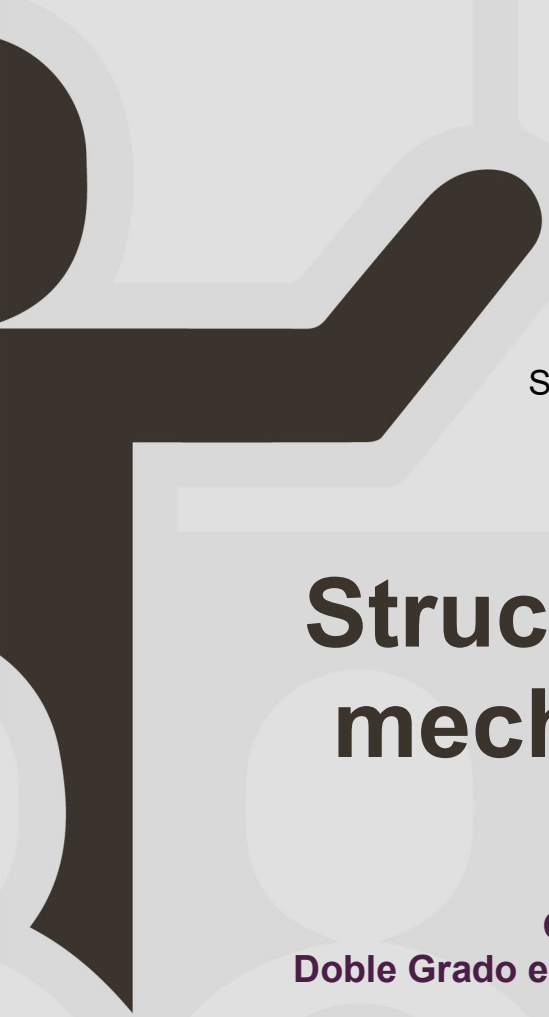
GUÍAS DOCENTES



Universidad de Jaén

School of Engineering of Linares

Structural integrity in mechanical element

2024-2025

Grado en Ingeniería Mecánica
Doble Grado en Ingeniería Eléctrica e Ingeniería Mecánica

Guías docentes UJA

Horarios de tutorías

Llamamientos PAU

Syllabus 2024-25 - 14613006 - Structural Integrity in Mechanical Elements (Integridad estructural en elementos mecánicos)

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

Back | Full version (Spanish) | English

DEGREE: Grado en Ingeniería mecánica (14613006)
FACULTY: SCHOOL OF ENGINEERING OF LINARES
DEGREE: Doble grado en Ingeniería eléctrica e Ingeniería mecánica (14813015)
FACULTY: SCHOOL OF ENGINEERING OF LINARES
ACADEMIC YEAR: 2024-25
COURSE: Structural Integrity in Mechanical Elements

SYLLABUS

1. COURSE BASIC INFORMATION

NAME: Structural Integrity in Mechanical Elements
CODE: 14613006 (*) ACADEMIC YEAR: 2024-25
LANGUAGE: English LEVEL: 1
ECTS CREDITS: 6.0 YEAR: 4 SEMESTER: SC

2. LECTURER BASIC INFORMATION

NAME: ALMAZÁN LÁZARO, JUAN ANTONIO
DEPARTMENT: U121 - INGENIERÍA MECÁNICA Y MINERA
FIELD OF STUDY: 545 - INGENIERÍA MECÁNICA
OFFICE NO.: D - 042 E-MAIL: jalmazan@ujaen.es P: -
WEBSITE: -
ORCID: -
LANGUAGE: - LEVEL: 1

3. CONTENT DESCRIPTION

- Part 1: It will deal with the vibration concepts most applicable in industry.
- Part 2: This block will focus on fracture mechanics, an advanced approach to assessing structural integrity.
- Part3: Advanced methods of fatigue analysis and monitoring of fatigue-generated defects.

PART 1: VIBRATIONS

Unit 1. Fundamentals of vibration

Introduction.

Basic concepts of vibration.

Classification of vibration.

Concepts
of vibration transmission in structures. Transfer function.

Unit 2. Industrial applications

Modal
analysis of components.

Simulation
of vibration processes.

Experimental
measurement systems (vibrometry/imaging/accelerometers).

Machine
balancing and unbalancing.

Predictive
maintenance/Relation between vibration response and structural integrity.

Laboratory activities. Part 1:

- **Activity 1.** Determination and adjustment of transfer functions.
- **Activity 2.** Simulation by Finite Element Method of industrial component subjected to vibration - ABAQUS.

Part 2: FRACTURE

Unit 3. Introduction

Unit 4. Linear Elastic Fracture

Griffith's
energy balance.

Modification
of the Griffith equation.

The
rate of energy release.

The
instability of the R-curve.

Unit 5. Elasto-Plastic Fracture Mechanics.

The
displacement of the crack front opening.

The
J Integral and CTOD. Relationships.

R-curves
of material resistance in Elasto-Plastic Fracture.

Laboratory activities. Part 2:

- **Activity 3.** Experimental laboratory test of fracture in a cracked component.
- **Activity 4.** Simulation by Finite Element Method of fracture on industrial component - ABAQUS.

PART 3: FATIGUE

Unit 6. Introduction and classification

Unit 7. Propagation and growth

Fracture mechanics applied to fatigue.

Fatigue in different materials.

Fatigue life prediction.

Unit 8. Industrial methods for the inspection of cracks and defects.

Laboratory activities. Part 3:

Activity 5. Fatigue simulation of industrial components using Finite Element Methods - ANSYS.

4. COURSE DESCRIPTION AND TEACHING METHODOLOGY

The course will be developed through lectures and exposure of general examples (M1 - Lectures, M2 - Exposure of theory and general examples and M3 - Introductory activities and problem solving).

With a total of 45 classroom hours and an estimated 90 hours of autonomous work by the student, in these classes the competences CEM2, CEM4, CEM9 will be developed.

The methodology used to teach the concepts of the subject that allow the development of these competences will be presented through multimedia presentations, theoretical expositions and examples.

Practical:
Certain content will be explored through activities that involve the practical application of knowledge (M11 - Exercise resolution and M6 - Practical activities). This will develop the competences CEM2, CEM4, CEM9 and also CT4 through the use of computer equipment.

Collective
tutorials. This activity is organised in short seminars where, by means of problems, some of the subjects studied in the lectures will be studied in depth, and students' doubts will also be solved.

Seminars.
A seminar/visit will be organised on some of the topics related to the context in which the subject is developed.

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 based on RD 1125/2003 of 5 September, which establishes the European credit system and the grading system for official university degrees.

For the evaluation of the subject, an exam will be the main evaluation procedure (55% of the final grade of the subject) with which the competences CEM2, CEM4 and CEM9 and Outcomes 20, 21 and 22 will be evaluated. However, in order to encourage and reward continuous work throughout the subject, other evaluation criteria have been taken into account such as attendance and participation in class, laboratory practice reports (which will allow the evaluation of the competence CT4 in addition to the above) and delivery of activities proposed by the teacher.

As far as the exam is concerned, students must obtain a minimum mark of four out of ten in order to pass the course. It should be added that attendance at the practicals, as well as the delivery of the practical reports, is compulsory. Additionally, it is necessary to obtain a minimum of 3 points out of 10 in each of the internship reports submitted. Failure in the practical reports on the dates set by the teacher will mean failing the course.

The student could request an evaluation by means of a single test in which the weight of the exam would be 100% whenever justified circumstances arise in accordance with article 13 of the Regulations for the Academic Regime and Evaluation of Students of the University of Jaén. The request, accompanied by the justification, must be made during the period in which the teaching of classes is taught.

6. BOOKLIST (Access the bibliography in the Library catalog)

MAIN BOOKLIST:

- Fracture mechanics: fundamentals and applications. Edition: 3rd. Author: Anderson T. L.. Publisher: CRC Taylor & Francis (Library)

7. SUSTAINABLE DEVELOPMENT GOALS

Industria, innovación e infraestructura

Ciudades y comunidades sostenibles

Producción y consumo responsables

DETAILED INFORMATION

Linked with the SDGs (Sustainable Development Goals):

- SDG 9 . Industry, innovation and infrastructure. Promoting the use of new technologies and the efficient use of resources, by studying in depth the structural requirements of a system.
- SDG 11. Sustainable cities and communities. Developing materials and properties that enable the implementation of quality infrastructures.
- SDG 12. Responsible production and consumption. Correctly dimensioning structural elements and optimising the amount of resources used based on an in-depth knowledge of the behaviour of the materials used.

8. VIRTUAL / CLASSROOM TEACHING SCENARIO

On-site scenario:

Teaching activities	Format(on-site/on-line)*	Teaching methodology. Description

Clases of theory for all the group (big groups)	On-site 100%	Classes on-site as scheduled in the program.
Practical activities (small groups)	On-site 100%	Practical activities
Student support (big group)	On-site 100%	Question solving for students
Student support	On-site / on-line	Student support

The assesment system:

Item	**Criteria**	**Tool**	**Weight**
Attendance / participation	Active participation in the classroom and tutoring houfhg both face-to-face and on-line.	Professor's observations and notes.	5%
Practices	Delivery of the proposed problems or activities. The attendance to these sessions is mandatory.	Evaluation of the deriverables	35%
Works	Delivery of the proposed problems or activities.	Evaluation of the deriverables	40%
Theory exam	Exam about the subject contents	Theory exam	20%

9. VIRTUAL TEACHING SCENARIO

On-line scenario:

Teaching activities	**Format(on-site/on-line)***	**Teaching methodology. Description**
Clases of theory for all the group (big groups)	On-line100%	Classes on-site as scheduled in the program.
Practical activities (small groups)	On-site 100%	Practical activities.
Student support (big group)	On-site 100%	Question-solving for the group of students
Student support	On-site 100%	Student support

The assessment system

Item	**Criteria**	**Tool**	**Weight**

Attendance / participation	Active participation in the classroom and tutoring houfhg both face-to-face and on-line.	Professor's observations and notes.	5%
Practices	Delivery of the proposed problems or activities. The attendance to these sessions is mandatory.	Evaluation of the deriverables	35%
Works	Delivery of the proposed problems or activities.	Evaluation of the deriverables	40%
Theory exam	Exam about the subject contents	Theory exam	20%

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