GUÍAS DOCENTES

Universidad de Jaén

School of Engineering of Linares

Machine design

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 - 14612005 - Machine Design (Diseño de máquinas)

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 (14612005)
FACULTY: SCHOOL OF ENGINEERING OF LINARES
DEGREE: Doble grado en Ingeniería eléctrica e Ingeniería mecánica (14812009)
FACULTY: SCHOOL OF ENGINEERING OF LINARES
ACADEMIC YEAR: 2024-25
COURSE: Machine Design

SYLLABUS

1. COURSE BASIC INFORMATION

NAME: Machine Design
CODE: 14612005 (*) ACADEMIC YEAR: 2024-25
LANGUAGE: English LEVEL: 1
ECTS CREDITS: 6.0 YEAR: 3 SEMESTER: SC

2. LECTURER BASIC INFORMATION

NAME: FELIPE SESE, LUIS ANTONIO
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FIELD OF STUDY: 545 - INGENIERÍA MECÁNICA
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LANGUAGE: English LEVEL: 1

3. CONTENT DESCRIPTION

Block I. Fundamentals of machine designing

1. Introduction to Design

1.1 Design engineering

1.1.1 Stages of the design process

1.1.2 Design Considerations

1.2 Considerations of stress, strength and safety factor

1.3 Reliability. Safety and reliability

1.4 Economic factors in the design

1.5 Units Systems

Item 2. Materials for building machines

2.1 Mechanical properties of materials

2.1.1 Stress test. Static strengh

2.1.2. Elasticity and plasticity

2.1.3 Hardness

2.1.4 Fragility and ductility

2.1.5 Effect of temperature

2.1.6 Stress concentration

2.2 Materials more commonly used for the construction of machines

2.2.1 Casting

2.2.2 Steel. Heat treatments. Cold work

2.2.3 Alloy and stainless steels

2.2.4 Light materials

2.2.5 Other materials

Item 3. Analysis of stress and strain

3.1 Stress and Strain

3.1.1 Stress and axial deformation. Hooke's Law

3.1.2 Shear strain

3.1.3 Multiaxial stress states. Generalized Hooke's law

Transformations stress 3.2

3.2.1 Mohr Circle for plane stress

3.2.2 Application of the three-dimensional Mohr circle analysis efforts

3.3 Bending and torsional

3.3.1 General theory of bending. Bending moment and normal stress

3.3.2 Bending beams. Shear beams

3.3.3 General Theory of torque. Torque and shear stress

3.4 Tension machine elements

3.4.1 Concentration of effort

3.4.2 Flexion in curved beams

3.4.3 Tensions in forced settings and rotating rings

3.4.4 Tensions Contact

3.5 Deformation machine elements

3.5.1 Strain axial load, torsion and bending

3.5.2 Method area of momentum

3.5.3 Strain Energy

3.5.4 Theorem Castigliano

3.5.5 Capacity to absorb energy

3.6 Elements subjected to compression

3.6.1 Elements under compression. Columns and struts

3.6.2 Elements subjected to short and focused compression Eccentric

3.6.3 Slender elements under compression centered

3.6.4 Slender members subjected to eccentric compression

Block II. Failure conditions in elements

Item 4. Static considerations in the design of machine elements

4.1 Design for static strength

4.1.1 Concentration of stress to static load

4.1.2 Static criteria failure

4.1.3 Failure ductile and brittle materials. Notch sensitivity

4.2 Static Fracture

4.2.1 ductile fracture and brittle fracture

4.2.2 Factor intensification of effort. Fracture toughness

4.2.3 Fracture modes

Item 5. Dynamic considerations for mechanical design

5.1 Design for fatigue resistance against alternating loads

5.1.1 S-N diagram. Fatigue strength and fatigue limit

5.1.2 Correction fatigue limit. Factors Marin

5.2 Design resistance to fatigue by fluctuating loads

5.2.1 Influence of the average voltage. Fatigue failure theories

5.2.2 Alternative stress equivalency

5.2.3 Load line. Safety factors

5.2.4 Combined loads fluctuating. If brittle materials

5.2.5 Surface Fatigue

5.3 Accumulated fatigue damage

5.3.1 S-N diagram for damaged materials. Miner and Manson laws

5.3.2 Damage caused by average load states

5.3.3 Correction fatigue limit of damaged materials.

5.3.4 Crack propagation under cyclic loading

B lock III. Design of machine elements

Item 6. Drive shafts

Item 7. Mechanical springs

Item 8. Rolling bearings

Item 9. Joins

Item 10. Gears

The contents are intended to align with the following Sustainable Development Goals:

Goal 9: Build resilient infrastructure, promote sustainable industrialization and foster innovation
Goal 13: Take urgent action to combat climate change and its effects
Goal 12: Guarantee sustainable consumption and production patterns

4. COURSE DESCRIPTION AND TEACHING METHODOLOGY

The course will be developed through:

Lectures (M1 - Lectures, M2 - Exhibition of theory and general examples and M3 - introductory and

troubleshooting activities). The basic concepts of the subject will be presented through multimedia presentations, theoretical presentations, and implementation examples. With a total of 45 contact hours and autonomous work by the student estimated 67.5 horas.En these classes specific skills CEM2, CEM4 and CEM9 well as CB2, CB3, CB5 and CT2 general be developed

Practices (M11 - Solving exercises, M9 - Laboratories). Some content will be explored through activities involving the practical application of knowledge. It will employ a total of 10.0 contact hours and autonomous work by the student estimated 15.0 hours. In these classes CEM2 specific skills will be developed, and CEM9 and general CT2 CT4 CT6 CB4 and CB5 for which the student must submit the document of the corresponding work. Specifically there will be 5 laboratory practices as well as practical classes of exercises in which students will participate actively in the planning and development of them.

Group tutorials (M17 - Clarification of doubts). This activity is organized by short seminars where problems will deepen in some of the topics covered in lectures and doubts resolved alumnos.Con It also aims at strengthening the skills and CT2 CEM2

Seminars (M15 - Seminar). One seminar of some similar themes to the context in which the subject is developed will be organized. This is intended to strengthen the powers CEM2 and CT2

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

As host of evaluation of the course, an exam (75% of the final grade for the course) will be held to assess the skills CT2 CEM2 CB2 and CB3 CEM4 CEM9 CT6. However, in order to boost the ongoing workload and deprive the review has taken into account other evaluation criteria such as attendance and participation in class, reports of laboratory practice and delivery of activities proposed by the teacher, the latter two important processes to assess the skills CT4
CEM2 CT2 and CT6 CB4 CB5 CEM9. Thus the ability to transmit information and self-employment always related to the subject is reinforced.

With regard to the examination, it is necessary that students acquire a minimum score of 4 points over 10 to pass the course and take into account the practice califications.

Regarding the practices, to pass the subject is necessary to add that it is compulsory to attend all practices. Also delivering memories practices (in the stipulated time for it) is absolutely mandatory. In addition, you should obtain an average mark of 5 or higher on the deliverables of them. Additionally, it may not be less than 3.5 in some practice to consider average.

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 Regulation of 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:

- Diseño en ingeniería mecánica de Shigley . Edition: -. Author: Budynas, Richard G.. Publisher: México [etc.] : McGraw-Hill, 2008. (Library)
- Diseño en ingeniería mecánica de Shigley [Recurso electrónico] Richard G. Budynas, J. Keith Nisbett. Edition: 10ª ed. Author: Budynas, Richard G.. Publisher: McGraw-Hill, (Library)
- Diseño de elementos de máquinas Robert L. Mott. Edition: 4ª ̇ed.. Author: Mott, Robert L.. Publisher: Pearson Educación (Library)

ADDITIONAL BOOKLIST:

- Diseño en Ingeniería mecánica. Edition: 6ª ed. Author: Shigley, Joseph Edward. Publisher: Mexico [etc.]: McGraw Hill, 2002 (Library)
- Diseño en Ingeniería mecánica. Edition: 5ª ed. Author: Shigley, Joseph Edward. Publisher: Mexico [etc.]: McGraw Hill, [1995] (Library)
- Diseño en Ingeniería mecánica. Edition: 4ª ed. Author: Shigley, Joseph Edward. Publisher: Mexico [etc.]: McGraw Hill, 1986 (Library)

7. SUSTAINABLE DEVELOPMENT GOALS

Industria, innovación e infraestructura

Producción y consumo responsables

DETAILED INFORMATION

The content of the subject tries to raise awareness of the importance of mastering mechanical characteristics to optimize the design of mechanical actuators.

In this way, throughout all the topics the different points related to ODS 9 will be developed: Industry, Innovation, and Infrastructure: Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation.

As well as ODS 12 related to design optimization, Objective 12: Responsible production and consumption. Guarantee sustainable consumption and production patterns.

8. VIRTUAL / CLASSROOM TEACHING SCENARIO

TEACHING METHODOLOGY AND TRAINING ACTIVITIES

Formation activities	**Format (classroom / online) ***	**Teaching methodology Description**
45 hours in theory sessions on the contents of the program	In-person at 50%	Participatory master classes of one / two hour / s each, held in the classroom and / or broadcasting by videoconference to the rest of the group. If necessary, periodic student rotation would be used.
10 hours divided into practical sessions in laboratories or problem solving / exercise sessions.	100% in class	It will be held in practice groups of 20 students maximum. Development of practical laboratory sessions, lasting one hour each, in groups if possible or online / through videos otherwise. The sessions of problem solving and exercises promote the capacity of analysis and synthesis by solving small exercises. They will consist of one-hour participatory in-class sessions in practice groups resorting to 50% attendance and rotation if necessary.
Tutoring	In-class and on-line	Tutoring sessions will be attended in person or online at the scheduled time.

ADDITIONAL RESOURCES TO PRESENTIAL TRADITIONALS:

As synchronous tools the following will be used:

-Carrying out of classes at the original time of the subject using videoconferencing tools.

-Making tutorials through videoconference.

As asynchronous tools or the following will be used:

-Facilitation of study material through virtual teaching platform.

-Generation of doubts consultation tools through the virtual teaching platform.

EVALUATION SYSTEM

Both for ordinary and extraordinary Call:

Assessment test	Format (face-to-face / online synchronous or asynchronous)	Description	Percentage
Practical theory exam	In-class	Mastery of the theoretical and practical contents in face-to-face exam.	60%

		A grade of 5 out of 10 must be passed to choose to pass the course and take into account the rest of the grades.	
Active participation	Online / in-class	Notes	5%
Other aspects for continuous evaluation:	Online	Works / projects and present them	35%
	In class	Based on practices: ▪ Perform the deliverable exercises. ▪ Delivery of practice report (compulsory attendance attendance). Both concepts are compulsory to pass the subject.	

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.

9. VIRTUAL TEACHING SCENARIO

TEACHING METHODOLOGY AND TRAINING ACTIVITIES

Formation activities	**Format (classroom / online) ***	**Teaching methodology Description**
45 hours in theory sessions on the contents of the program	Online	Sessions of participatory master classes, one / two hour / s each, conducted by videoconference at the established time.
10 hours divided into practical sessions in laboratories or problem solving / exercise sessions.	Online	Substitution of practical sessions and resolution of exercises by similar teaching activities in online format consisting of the approach of solving practical cases of the subject and laboratory cases. The synchronous and asynchronous modality will be combined depending on the activities that are proposed.
Tutoring	On-line	Tutoring sessions will be attended in nline at the scheduled time.

ADDITIONAL RESOURCES TO PRESENTIAL TRADITIONALS:

As synchronous tools the following will be used:

-Carrying out of classes at the original time of the subject using videoconferencing tools.

-Making tutorials through videoconference.

As asynchronous tools or the following will be used:

-Facilitation of study material through virtual teaching platform.

-Generation of doubts consultation tools through the virtual teaching platform.

EVALUATION SYSTEM

Both for ordinary and extraordinary Call:

Assessment test	Format (face-to-face / online synchronous or asynchronous)	Description	Percentage
Practical theory exam	Online	Mastery of the theoretical and practical content of the online exam. A grade of 5 out of 10 must be passed to choose to pass the course and take into account the rest of the grades.	60%
Active participation	Online	Notes	5%
Other aspects for continuous evaluation:	Online	Works / projects and present them	35%
	Online	Based on practices: ▪ Perform the deliverable exercises. ▪ Delivery of practice report (compulsory attendance attendance). Both concepts are compulsory to pass the subject.	

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.

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