GUÍAS DOCENTES

Universidad de Jaén

School of Engineering of Linares

Theory of structures

2024-2025

Grado en Ingeniería Civil
Grado en Ingeniería de Recursos Energético
Grado en Ingeniería de Tecnologías Mineras
Doble Grado en Ingeniería de Recursos Energéticos e Ingeniería Química Industrial
Doble Grado en Ingeniería de tecnologías mineras e Ingeniería civil

Guías docentes UJA

Horarios de tutorías

Llamamientos PAU

Syllabus 2024-25 - 14012024 - Theory of Structures (Teoría de estructuras)

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 civil (14012024)
FACULTY: SCHOOL OF ENGINEERING OF LINARES
DEGREE: Grado en Ingeniería de minas (14112020)
FACULTY: SCHOOL OF ENGINEERING OF LINARES
DEGREE: Grado en Ingeniería de recursos energéticos (14212021)
FACULTY: SCHOOL OF ENGINEERING OF LINARES
DEGREE: Doble grado en Ingeniería de tecnologías mineras e Ingenieria civil (15012028)
FACULTY: SCHOOL OF ENGINEERING OF LINARES
DEGREE: Doble grado en Ingeniería de recursos energéticos e Ing. química industrial (15112038)
FACULTY: SCHOOL OF ENGINEERING OF LINARES
ACADEMIC YEAR: 2024-25
COURSE: Theory of Structures

SYLLABUS

1. COURSE BASIC INFORMATION

NAME: Theory of Structures
CODE: 14012024 (*) ACADEMIC YEAR: 2024-25
LANGUAGE: English LEVEL: 1
ECTS CREDITS: 6.0 YEAR: 2 SEMESTER: SC

2. LECTURER BASIC INFORMATION

NAME: SUÁREZ GUERRA, FERNANDO
DEPARTMENT: U121 - INGENIERÍA MECÁNICA Y MINERA
FIELD OF STUDY: 605 - MECÁNICA DE MEDIOS CONTINUOS Y TEORÍA DE ESTRUCTUR
OFFICE NO.: D - 050 E-MAIL: fsuarez@ujaen.es P: 953648606
WEBSITE: -
ORCID: https://orcid.org/0000-0002-8834-104X
LANGUAGE: - LEVEL: 1

NAME: CAMACHO SAMPEDRO, JOSÉ
DEPARTMENT: U121 - INGENIERÍA MECÁNICA Y MINERA
FIELD OF STUDY: 605 - MECÁNICA DE MEDIOS CONTINUOS Y TEORÍA DE ESTRUCTUR
OFFICE NO.: D - 068 E-MAIL: jsampedr@ujaen.es P: 953648678
WEBSITE: -
ORCID: -
LANGUAGE: - LEVEL: 1

3. CONTENT DESCRIPTION

Part A: ELASTICITY

CHAPTER I.- Introduction to Elasticity

- Introduction to Continuum Mechanics
- The elastic solid and its properties
- Hypothesis and principles

CHAPTER II.- Stresses

- The concept of stress

- Equilibrium equations
- Principal stresses. Invariants
- Plane stress
- Graphical representation of stresses. Mohr's circles

CHAPTER III.- Strains

- Introduction. Changes of volume and shape
- The concept of strain
- Strain tensor. Properties
- Compatibility equations
- Plane strain

CHAPTER IV.- Stress-strain relation

- The tensile test
- Transverse strain. Poisson's ratio
- Stress-strain relation. Hooke's law

CHAPTER V.- Energy methods in Elasticity

- Introduction. Strain energy
- Expression of the strain energy
- Yield criteria. Von Mises stress
- Energy theorems

Part B: STRENGTH OF MATERIALS

CHAPTER VI.- Basic concept of Strength of Materials

- Introduction
- Definition of loads on a cross-section
- General principles of the Strength of Materials
- External equilibrium and cross-section equilibrium
- Types of supports. Reactions
- Isostatic and hyperstatic systems

CHAPTER VII.- Tension and compression

- Stresses due to tension or compression
- Axial forces diagrams
- Strains due to axial forces
- Tension or compression due to self-weight

CHAPTER VIII.- Torsion

- Pure torsion. Torsion on circular shafts
- Torques

CHAPTER IX.- General theory of bending

- Pure bending. Navier's law
- Relation between shear and bending moment
- Diagrams of bending moments and shear forces
- Stresses due to shear. Collignon's theorem
- Principal stresses and Von Mises stress in bending

CHAPTER X.- Strain due to bending

- Differential equation for the elastic curve of a beam
- Double integration method
- Mohr's theorems
- Deflection due to shear
- Composite sections

CHAPTER XI.- Biaxial bending and bending under tension/compression

- Introduction
- Biaxial bending. Neutral axis
- Strains due to biaxial bending
- Bending under tension/compression.
- Neutral axis for bending under tension/compression

CHAPTER XII.- Buckling

- Introduction. Stability of columns
- Euler's formula
- Critical load depending on supports. Buckling length

Part C: STRUCTURAL ANALYSIS CLASSICAL METHODS

CHAPTER XIII.- Structural analysis classical methods

- Introduction to Structural Analysis
- Pinned structures. Isostatic trusses
- Pinned structures. Hyperstatic trusses

PRACTICAL SESSIONS

There will be five practical tasks related to several topics explained in the theory classes. In each of them, the student will have to write a report solving a given problem.

The activities programmed in this course are aligned with the Sustainable Development Goals (SDG), more especifically, with SDG 4, "Quality education" and SDG 9, "Industry, innovation and infrastructure".

4. COURSE DESCRIPTION AND TEACHING METHODOLOGY

Not required.

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

- Attendance and participation (5%)
- Attendance will be controlled in the practical sessions and the active participation of the student will be taken into account. A minimum of 70% of attendance to theory classes is required.
- Theoretical concepts (90%)
- Final exam with theory questions and problems. A mark over 0 will be required for the theory part of the exam. The weight of the theory will be 20% and the weight of the problems 80%.
- The following learning results are assessed: 3
- The following skills are assessed: CC3, CC4 and CG1
- Lab practical sessions / usage of ICT tools (5%)
- Practical sessions related with the content of the theory classes will be given. The student will have to prepare a report for each of the practical tasks and the average mark of these reports must be equal or over 5 in order to pass the practical part of the subject. To pass this subject, the student must pass both, the final exam and the practical tasks. If a student does not pass the practical part, he will not be able to pass the subject in the Ordinary exam (Convocatoria Ordinaria) and will have to sit an exam on the practical part for the Extraordinary exam (Convocatoria Extraordinaria), provided that the student has presented the tasks before the exam.
- The following learning results are assessed: 3
- The following skills are assessed: CC3, CC4 and CG1

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

MAIN BOOKLIST:

- Introduction to Linear Elasticity [Recurso electrónico]. Edition: 3rd ed. 2013. Author: Gould, Phillip L. Publisher: New York, NY : Springer New York : Imprint: Springer, 2013.
  - **Notes**: -

(Library)

- Mechanics and Strength of Materials [Recurso electrónico]. Edition: -. Author: Silva, Vitor Dias. Publisher: Berlin, Heidelberg : Springer-Verlag Berlin Heidelberg, 2006. (Library)

7. SUSTAINABLE DEVELOPMENT GOALS

Educación de calidad

Industria, innovación e infraestructura

DETAILED INFORMATION

SDG 4: This subject contributes to considerably increasing the number of young people and adults who have the necessary skills, particularly technical and professional, to access employment, decent work and entrepreneurship.
SDG9: This subject contributes to developing reliable, sustainable, resilient and quality infrastructures, to support economic development and human well-being.

8. VIRTUAL / CLASSROOM TEACHING SCENARIO

TEACHING METHODOLOGY AND TRAINING ACTIVITIES

Training Activities	**Format (classroom/ *online*)**	**Teaching methodology Description**
10 lab practical sessions	Classroom-based at 50%	5 lab practical cases explained in 2 sessiones of 1 hour each, using specific software (Matlab and Robot Structural Analysis). They will be taught by means of classroom-based sessions and, if necessary, using videos and screencast.
Theory sessions	Classroom-based at 50%	They will be taught by means of classroom-based sessions and, if necessary, using videos and screencast.
Tutorials	*Online*	Tutorials will be online at their specified time during the week.

ASSESSMENT METHODOLOGY

Assessment method	Format	Description	Weight
Attendance and/or participation in classroom or online activities	Classroom-based at 50%	Attendance and participation in lab sessions and classroom exercises.	5%
Theory concepts	Classroom-based	Exam	50%
Exercises and case studies.	Classroom-based at 50%	Assessable exercises solved individually during theory classes.	20%
Lab/field sessions / ICT tools	Online	Lab sessions reports.	25%

To pass the course, the studing will have to pass both, the Exam and the Lab sessions reports, separately.

9. VIRTUAL TEACHING SCENARIO

TEACHING METHODOLOGY AND TRAINING ACTIVITIES

Training Activities	Format (classroom/ *online*)	Teaching methodology Description
10 lab practical sessions	Online	5 lab practical cases explained in 2 sessiones of 1 hour each, using specific software (Matlab and Robot Structural Analysis). They will be taught by means of videos and synchronous sessions.
Theory sessions	Online	They will be taught by means of videos and synchronous sessions.
Tutorials	Online	Tutorials will be online at their specified time during the week.

ASSESSMENT METHODOLOGY

Assessment method	Format	Description	Weight
Attendance and/or participation in classroom or online activities	Online	Attendance and participation in lab sessions and classroom exercises.	5%
Theory concepts	Online	Exam	50%
Exercises and case studies.	Online	Assessable exercises solved individually during theory classes.	20%
Lab/field sessions / ICT tools	Online	Lab sessions reports.	25%

To pass the course, the studing will have to pass both, the Exam and the Lab sessions reports, separately.

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