GUÍAS DOCENTES

Universidad de Jaén

School of Engineering of Jaén

Fluid mechanics

2024-2025

Grado en Ingeniería eléctrica (E.P.S. Jaén)
Grado en Ingeniería mecánica (E.P.S. Jaén)
Grado en Ingeniería electrónica industrial (E.P.S. Jaén)
Grado en Ingeniería de organización industrial (E.P.S. Jaén)
Doble Grado en Ingeniería eléctrica e Ingeniería mecánica (E.P.S. Jaén)
Doble Grado en Ingeniería eléctrica e Ingeniería electrónica industrial (E.P.S. Jaén)
Doble Grado en Ingeniería mecánica e Ingeniería electrónica industrial (E.P.S. Jaén)
Doble Grado en Ingeniería mecánica e Ingeniería de organización industrial (E.P.S. Jaén)

Acceso Mayores 40
Guías docentes UJA
Horarios de tutorías
Llamamientos PAU
Movilidad (Coordinador)
P.O.D.
Solicitud bilingüismo

Syllabus 2024-25 - 13412016 - Fluid Mechanics (Mecánica de fluidos)

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 (13412016)
FACULTY: SCHOOL OF ENGINEERING OF JAÉN
DEGREE: Doble grado en Ingeniería eléctrica e Ingeniería electrónica industrial (13712026)
FACULTY: SCHOOL OF ENGINEERING OF JAÉN
DEGREE: Doble grado en Ingeniería mecánica e Ingeniería de organización industrial (13812022)
FACULTY: SCHOOL OF ENGINEERING OF JAÉN
DEGREE: Grado en Ingeniería eléctrica (13512018)
FACULTY: SCHOOL OF ENGINEERING OF JAÉN
DEGREE: Grado en Ingeniería electrónica industrial (13112020)
FACULTY: SCHOOL OF ENGINEERING OF JAÉN
DEGREE: Grado en Ingeniería de organización industrial (13012016)
FACULTY: SCHOOL OF ENGINEERING OF JAÉN
DEGREE: Doble grado en Ingeniería eléctrica e Ingeniería mecánica (13612022)
FACULTY: SCHOOL OF ENGINEERING OF JAÉN
DEGREE: Doble Grado en Ingeniería mecánica e Ingeniería electrónica industrial (13912026)
FACULTY: SCHOOL OF ENGINEERING OF JAÉN
ACADEMIC YEAR: 2024-25
COURSE: Fluid Mechanics

SYLLABUS

1. COURSE BASIC INFORMATION

NAME: Fluid Mechanics
CODE: 13412016 (*) ACADEMIC YEAR: 2024-25
LANGUAGE: English LEVEL: 3
ECTS CREDITS: 6.0 YEAR: 2 SEMESTER: SC

2. LECTURER BASIC INFORMATION

NAME: BOLAÑOS JIMÉNEZ, Mª ROCIO
DEPARTMENT: U121 - INGENIERÍA MECÁNICA Y MINERA
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LANGUAGE: - LEVEL: 1
NAME: GUTIÉRREZ MONTES, CÁNDIDO
DEPARTMENT: U121 - INGENIERÍA MECÁNICA Y MINERA
FIELD OF STUDY: 600 - MECÁNICA DE FLUIDOS
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ORCID: https://orcid.org/0000-0003-1123-2002
LANGUAGE: - LEVEL: 3

3. CONTENT DESCRIPTION

1. Introduction to the Study of Fluid Mechanics. *Introduction to the course -. Solid vs fluid (gas and liquid). What Is A Fluid? Fluid properties -. Objectives, hypotheses and essential simplifications.- Basic Concepts. - Strategy in the study of fluids.*

2. Fluidostatics. *Forces acting on a fluid. Pressure. Fundamental equation of fluidstatics. Implications. Forces on surfaces. Archimedes principle. Examples.*

3. Fluid kinematics. *Fluid Field. Stationary and uniform flow. Path line, stream line, streak line, fluid line.*

4. Conservation Laws. *Introduction -. Conservation Laws -. Reynolds Transport Theorem. Continuity, momentum, energy equations. Applications.*

5. Dimensional analysis and physical similarity. *Basis of Dimensional Analysis. Buckingham Theorem. Dimensionless parameters. Physical Interpretation. Similarity.*

6. Flow in ducts. *Introduction -. Losses in Pipes: empirical equations - Darcy-Weissbach - Friction factor-. Dependence of friction factor with roughness and Reynolds number. Equations for the calculation of the friction factor -. laminar and turbulent solution. Colebrook equation - artificial and natural roughness - Methods of Calculation of friction factor in turbulent regime: iterations, approximate formulas and diagrams. The Moody diagram -. Local losses computation -. Interference.*

6. Introduction to flow in open channels. *Introduction and basic concepts.-Dimensional Analysis of the problem.- Flow classification.- Uniform flow: Analysis and optimums section.-Non-uniform flow: Specific Energy, Critical Depth. Hydraulic jump. Open channels flow meters.*

- Lab sessions: *during the semester there will be different lab sessions regarding: fluidstatics (P1), conservation laws (P2), ideal flow* (P4), intro to CFD *(P3)* or flow in ducts *(P5)*.

4. COURSE DESCRIPTION AND TEACHING METHODOLOGY

The teaching methodology will consist of three different types of activities:

- Lectures delivered at the classroom. In these classes the concepts previously commented will be introduced and explained by the lecturer. In addition, exercises related to the matter studied will be also solved. The methodology used will be that indicated previously.

- Lab sessions: an overallnumber of five lab sessions of two hours each will be held, four of them at the fluid mechanics experimental lab and another one at the pc-lab. These will consist of a theoretical introduction, followed by the measurements acquisition by the students. The students will subsequently analyze the results and compare them with the theoretical concepts studied to write an individual final report of each session. The methodology used will be that indicated previously.

- The collective mentoring sessions will consist of seminars related to the subject. There is a chance of these being delivered in Spanish. The methodology used will be that indicated previously.

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 final mark is divided into four different items:

1.- Attendance to theoretical lectures and involvement during lectures.

2.- Final exam. This will consist of two different parts: first, a theoretical/questions part; second, to solve some related problems. A minimum mark is needed to pass the exam.

3 y 4.- Laboratory test and proposed tasks solution. These will represent a percentage of the final mark (see assessment), divided into the lab reports or test and the so called "actividad dirigida" (research project). The lab sessions (attendance and reports (the latter if required)) are compulsory to pass the subject.

By means of the above assessements, the corresponding competences, specially CC2 and CT4, will be evaluated, as well as the corresponding results (7 to 12). In particular, assessment instruments S1, S3 and S4 will assist in evaluating CT4, whereas CC2 will be evaluated using S1 to S4. Finally, S1 to S4 will help in evaluating the basic competences associated with the subject, i.e. CBR2, CBR3 and CBR4.

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

MAIN BOOKLIST:

- Applied fluid mechanics. Edition: 4th ed. Author: Mott, Robert L.. Publisher: Prentice-Hall (Library)
- Fluid mechanics . Edition: 4th ed.. Author: Kundu, Pijush K.. Publisher: Elsevier Academic Press (Library)
- Fluid mechanics. Edition: 4th. ed. Author: Douglas, John F.. Publisher: Pearson Prentice Hall (Library)

7. SUSTAINABLE DEVELOPMENT GOALS

Educación de calidad

Agua limpia y saneamiento

Energía asequible y no contaminante

DETAILED INFORMATION

Goal 4: Quality Education. Ensure inclusive, equitable, and quality education and promote lifelong learning opportunities for all.

4.4 By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs, and entrepreneurship.

4.7 By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship, and appreciation of cultural diversity and cultureââ□¬â□¢s contribution to sustainable development.

Goal 6: Clean Water and Sanitation. Ensure availability and sustainable management of water and sanitation for all.

6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity.

Goal 7: Affordable and Clean Energy. Ensure access to affordable, reliable, sustainable, and modern energy for all.

7.b By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, particularly least developed countries, small island developing States, and landlocked developing countries, in accordance with their respective support programs.

8. VIRTUAL / CLASSROOM TEACHING SCENARIO

METHODOLOGY and ACTIVITIES

The following activities and methodologies are considered for the mixed format:

ACTIVITIES	
A1 - Exhibition classes in large group ▪ M1 - Master classes ▪ M2 - Theory exposition and general examples ▪ M3 - Introductory activities ▪ M4 - Conferences	Lectures given in the classroom (also by electronic means synchronously in the case of "face-to-face 50% rotating" format).
A2R - Small Group Classes ▪ M10R - Computer classrooms ▪ M11R - Resolution of exercises ▪ M12R - Presentations / exhibitions ▪ M6R - Practical activities ▪ M9R - Laboratories	Taught in the lab (also electronically synchronously in the case of "face-to-face rotating 50%" format).
A3 - Group / individual tutoring ▪ M14 - Supervision of directed works ▪ M15 - Seminars ▪ M16 - Discussions ▪ M17 - Clarification of doubts ▪ M18 - Comments of individual works	Taught in the classroom (also by electronic means synchronously in the case of "face-to-face 50% rotating" format).

ACTIVITIES	
▪ M19 - Presentations / exhibitions	

The training activities do not undergo any change with respect to the 100% classroom teaching case.

ASSESSMENT

The evaluation system is as follows:

ASPECT	CRITERIA	INSTRUMENT	WEIGHT
Attendance and / or participation in face-to-face and / or virtual activities Correct student intervention in class and tutoring.	Correct student intervention in class and tutoring.	Observation and notes of the teacher and the rest of the students.	5.0%
Theoretical concepts of the subject.	Mastery of the theoretical and practical content.	Written exam.	75.0%
Completion of works, cases or exercises.	Correct resolution of the proposed works. Clarity of presentation and exposition of the same.	Delivery of works.	10.0%
Laboratory / field practices / use of ICT tools	Correct instrumentation management and data processing and analysis.	Evaluation of the practices by means of test.	10.0%

It will be necessary to have obtained a minimum grade in the final exam to pass the subject and proceed with the average of the remaining items.

The attendance to the lab sessions is compulsory. If a student has not attended all the laboratory practice sessions, they will not be able to take the exam and therefore will not be graded.

Through the different evaluation instruments, the competences will be evaluated, and especially the CC2 and CT4, as well as the corresponding results.

3) RESOURCES

Although the training activities or the methodology have not undergone any modification (except for the broadcasting of the classes if necessary), if the theory teaching were in a "50% rotating classroom teaching" format, this would be carried out in part of virtual form (in its synchronous modality), with no variation for the remaining 50% of classroom teaching. In this sense, the methodology would remain the same, that is, classes using presentations and whiteboards, seminars, etc., but they would in turn be broadcast through virtual sessions in google-meet or similar to 50% of students who were in virtual format at that time.

The practical classes will continue to take place in a 100% classroom setting in the laboratory. If this is not possible, these will be in a "rotating classroom teaching" format, that is, face-to-face attention from 50% of the group, while the remaining 50% will attend the class by telematic means, performing the calculations and processing data corresponding to the practice object of study.

9. VIRTUAL TEACHING SCENARIO

METHODOLOGY and ACTIVITIES

The following activities and methodologies are considered for the mixed format:

ACTIVITIES	
A1 - Exhibition classes in large group ▪ M1 - Master classes ▪ M2 - Theory exposition and general examples ▪ M3 - Introductory activities ▪ M4 - Conferences	Taught by telematic means synchronously.
A2R - Small Group Classes ▪ M10R - Computer classrooms ▪ M11R - Resolution of exercises ▪ M12R - Presentations / exhibitions ▪ M6R - Practical activities ▪ M9R - Laboratories	Taught by telematic means synchronously..
A3 - Group / individual tutoring ▪ M14 - Supervision of directed works ▪ M15 - Seminars ▪ M16 - Discussions ▪ M17 - Clarification of doubts ▪ M18 - Comments of individual works ▪ M19 - Presentations / exhibitions	Taught by telematic means synchronously.

The training activities do not undergo any change with respect to the 100% classroom teaching case.

ASSESSMENT

The evaluation system is as follows:

ASPECT	CRITERIA	INSTRUMENT	WEIGHT
Attendance and / or participation in face-to-face and / or virtual activities Correct student intervention in class and tutoring.	Correct student intervention in class and tutoring.	Observation and notes of the teacher and work of the rest of the students.	5.0%
Theoretical concepts of the subject.	Mastery of the theoretical and practical content.	Exam.	75.0%
Completion of works, cases or exercises.	Correct resolution of the proposed works. Clarity of presentation and exposition of the same.	Delivery of works.	10.0%
Laboratory / field practices / use of ICT tools	Correct instrumentation management and data processing and analysis.	Evaluation of the practices by means of test.	10.0%

It will be necessary to have obtained a minimum grade in the final exam to pass the subject and proceed with the average of the remaining items.

The attendance to the lab sessions is compulsory. If a student has not attended all the laboratory practice sessions, they will not be able to take the exam and therefore will not be graded.

Through the different evaluation instruments, the competences will be evaluated, and especially the CC2 and CT4, as well as the corresponding results.

3) RESOURCES

Although the teaching activities or the methodology have not undergone any modification, the teaching is carried out virtually (in its synchronous mode) in its whole. In this sense, the methodology remains the same, that is, classes using presentations and whiteboards, seminars, etc., but they are taught through virtual sessions in google-meet or similar. Also, despite the fact that the students have all the material for the classes (presentations, book, problems, scripts, etc.), additional material has been generated to support the students that complement their training.

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