GUÍA DOCENTE
2023 - 2024

FICHA TÉCNICA DE LA ASIGNATURA

Datos de la asignatura	
Nombre completo	Optativa Complementaria. Fire Numerical Simulation
Código	DIM-OPT-422
Impartido en	Grado en Ingeniería en Tecnologías Industriales [Cuarto Curso]
Nivel	Reglada Grado Europeo
Cuatrimestre	Semestral
Créditos	3,0 ECTS
Carácter	Optativa (Grado)
Departamento / Área	Departamento de Ingeniería Mecánica
Responsable	Pablo Ayala Santamaría
Horario	Mañana
Horario de tutorías	Lunes a jueves 8AM a 6 PM

Datos del profesorado	
Profesor	
Nombre	Pablo Ayala Santamaría
Departamento / Área	Departamento de Ingeniería Mecánica
Despacho	Alberto Aguilera 25
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DATOS ESPECÍFICOS DE LA ASIGNATURA

Contextualización de la asignatura

Aportación al perfil profesional de la titulación

Within the professional profile of the graduate in Electromechanical Engineering, applied knowledge of Mechanical Engineering is required. This subject demonstrates the application of various topics acquired throughout different courses within the degree program in the field of Fire Safety.

This course will provide a practical approach to different simulation challenges in fire safety problems, including smoke movement in large spaces (shopping malls, subway/train stations, tunnels, etc.), fire development in industrial buildings, and more.

By the end of the course, students will have acquired the tools and knowledge to address various simulation challenges in the field of fire safety.

Prerequisitos

Knowledge of fluid mechanics and heat transfer.

Competencias - Objetivos

Competencias

CG3. Knowledge on basic and technological matters that help the learning of new method and theories. Student will be trained to be flexible in front of new challenges.

CG4. Ability to solve new problems, make decisions, be creative, critical reasoning and to communicate knowledge and skills inside the Industrial Engineering field.

Resultados de Aprendizaje

RA1. Be aware of the fire safety risks.

RA2. Understand the smoke control and management system..

RA3. Carry out numerical models to simulate fire dynamics.

RA4. Familiarity with reports similar to those found in industry.

BLOQUES TEMÁTICOS Y CONTENIDOS

Contenidos – Bloques Temáticos

Section 1: Introduction to Fire Safety and Fire Numerical Modelling

- Heat Transfer
- Fluid Mechanics
- Combustion

Section 2: Computational Fluid Dynamics (I): Fire Dynamics Simulator (FDS)

- Introduction to turbulence models
- Combustion models
- Radiation models
- Advantages, disadvantages and limitations.
- Case of Study

Section 3: Computational Fluid Dynamics (II): Fire Dynamics Simulator (FDS)

- Geometry
- Meshes
- Boundary Conditions
- Outputs
- Case of Study

Section 4: Compartment Fires

- Description of compartment fires
- Case of study

Section 5: Large compartments: Smoke Control Systems

- Ventilation
- Case of Study

Section 6: Critical Infrastructures: Tunnel Fire Ventilation

- Introduction to tunnel ventilation
- Case of study

Section 7: Workshop. Development of the Final Project

METODOLOGÍA DOCENTE

Aspectos metodológicos generales de la asignatura

In order to achieve the competencies proposed in the sessions, the active participation of the students in the learning activities will be promoted.

Metodología Presencial: Actividades

1. **Lectures:** Explanation of the main concepts and methodologies by the professor. They will be supported by applied examples and the active participation of students will be encouraged.
2. **Case of study:** The case study of each lecture will be solved cooperatively by the students with the support of the professor.
3. **Office hours** will be held individually or in groups to solve students' doubts after they have studied the different topics.

Metodología No presencial: Actividades

1. **Individual study** of the lectures to be discussed in subsequent classes. The student should analyze the lecture to apply its content to the final project.
2. **Case of study.** The final project of the course will be developed individually or in groups, applying the knowledge acquired in the different lectures. This project will be proposed and supervised by the professor of the course.

The main objective of the non-classroom work is to apply in a practical way the different concepts worked on during the lectures. Therefore, the student comes to understand, comprehend and assimilate in a practical way the different concepts.

RESUMEN HORAS DE TRABAJO DEL ALUMNO

Classroom hours:

- Lecture: 20 hours.
- Resolution of case studies: 10 hours.

Non-classroom hours:

- Practical work on the case study: 50 h.
- Report: 10 hours.

EVALUACIÓN Y CRITERIOS DE CALIFICACIÓN

Active participation in class: 5%.

- Attend class.
- Participate in the different case studies of the different lectures.

Final Project: Case study: 70%.

- Development of a fire model.
- Report including the analysis of results.
- Oral presentation.

Final exam: 25%.

Calificaciones

Ordinary call:

- The course grade is distributed as follows: 5% for active participation, 70% for the final project, and 25% for the final exam.
- The final project can be completed individually or in groups. It will be presented as a written report in paper format and also orally.
- To pass the course, a minimum grade of at least 5/10 is required for the final project and at least 4/10 for the final exam.

Extraordinary call:

- If you passed any part(s) in the ordinary call, the grades for those part(s) will be retained, and you will only need to retake the part(s) you failed.
- The calculation of the final grade will follow the same distribution as the ordinary exam, with the grade(s) of the failed part(s) updated accordingly.
- For students who failed the final exam, an extraordinary theoretical test will be required. If the final work was not satisfactory, the student must repeat it individually.

It is important to note that attendance is crucial. Failure to attend more than 15% of the classes may result in the loss of the right to sit for both the ordinary and extraordinary exams for this subject (as specified in article 93.3 of the General Regulations, and articles 7.2 and 7.3 of the Academic Norms).

BIBLIOGRAFÍA Y RECURSOS

Bibliografía Básica

1. SFPE Handbook of Fire Protection Engineering, 5th Edition, SFPE, 2016.
2. Quintiere, J.G, "Fundamentals of Fire Behaviour," John Wiley and Sons, 2011.
3. Drysdale, D.D. "An Introduction to Fire Dynamics," John Wiley and Sons, 3rd Edition, 2011.

Bibliografía Complementaria

Each lecture of the course will be supported by specific bibliography.