

## Combustion

Academic Year: ( 2022 / 2023 )

Review date: 12-05-2022

Department assigned to the subject: Aerospace Engineering Department

Coordinating teacher: DOMINGUEZ VAZQUEZ, ADRIAN

Type: Electives ECTS Credits : 3.0

Year : 4 Semester :

## REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Fluid Mechanics I and II  
Thermal Engineering  
Chemical basis of Engineering

## OBJECTIVES

Basic knowledge of combustion processes, their physical laws, and their applications to propulsion

## DESCRIPTION OF CONTENTS: PROGRAMME

1. Introduction to combustion phenomena and fuels.
  - 1.1. Combustion in aerospace and industrial applications.
  - 1.2. Hydrocarbon basic nomenclature.
2. Thermochemistry.
  - 2.1. Fundamental laws of Thermodynamics.
  - 2.2. Adiabatic Flame Temperature and combustion heat.
  - 2.3. Chemical equilibrium and dissociation processes.
3. Chemical kinetics.
  - 3.1. Arrhenius' equation.
  - 3.2. Complex and single-step combustion mechanism.
  - 3.3. Pollutants formation. Zeldovich mechanism.
4. Analysis of simple reacting systems.
  - 4.1. Closed systems: constant pressure/volume reactors.
  - 4.2. Open systems.
5. Mass and heat diffusion of gas mixtures. Evaporation of liquids
  - 5.1. Mass diffusion. Fick's Law and Stefan's Problem.

## LEARNING ACTIVITIES AND METHODOLOGY

The methodology combines

- 1) lecture classes presenting the different subjects
- 2) problem solving sessions
- 3) computer lab sessions, development or use of simple numerical tools to describe different combustion phenomena
- 4) homework sets of exercises
- 5) quizzes

Homework and quizzes and computational labs contribute to continuous evaluation mark.

In the academic year 2020-21, approximately half of the sessions will be online (synchronous), the rest will be in normal class-rooms in small groups of students.

Tutorials can be both personally or through Aula Global. In the academic year 2020-21 all tutorials will be on-line due to the COVID19 emergency.

## ASSESSMENT SYSTEM

In order to pass the subject in the ordinary call, two requirements need to be met:

- 1) to have a MINIMUM mark of 4.0 over 10 in the end-of-term exam;
- 2) to have a minimum overall mark of 5.0 over 10 (weighing 60% the end-of-term exam mark and 40% the mark of the continuous evaluation).

<b>% end-of-term-examination:</b>	60
<b>% of continuous assessment (assignments, laboratory, practicals...):</b>	40

#### BASIC BIBLIOGRAPHY

- I. GLASSMAN, R. YETTER, N. GLUMAC COMBUSTION, 5TH EDITION, ACADEMIC PRESS, 2015
- STEPHEN R. TURNS AN INTRODUCTION TO COMBUSTION, 3RD EDITION, MAC GRAW-HILL INTERNATIONAL, 2012

#### ADDITIONAL BIBLIOGRAPHY

- C.K. LAW Combustion Physics, Cambridge University Press, 2006
- K.K. KUO Principles of combustion, 2nd. edition, Wiley, 2005