Turbulence

Academic Year: (2021 / 2022) **Review date: 02-04-2020**

Department assigned to the subject: Bioengineering and Aeroespace Engineering Department

Coordinating teacher: GARCIA-VILLALBA NAVARIDAS, MANUEL

Type: Electives ECTS Credits : 6.0

Year : 1 Semester : 2

DESCRIPTION OF CONTENTS: PROGRAMME

1 Introduction

2 Statistical description
2.1 Statistical tools
2.2 Reynolds-averaged Navier Stokes equations
2.3 Closure Problem

3 Free shear flows
3.1 Mixing layers, jets, wakes.

4 The scales of turbulent flows
4.1 Energy cascade

5 Wall-bounded shear flows
5.1 Channel flow, pipe flow, boundary layers.

6 Modelling turbulence: DNS, LES, RANS

7 Introduction to RANS modelling
7.1 Eddy-viscosity models
7.2 Reynolds-stress models

8 Introduction to LES modelling

LEARNING ACTIVITIES AND METHODOLOGY

There will be theory lectures to introduce the physics of turbulent flows and its modelling. The students will need to solve simple problems with analytical solution. In addition they will need to solve numerical problems using Matlab or any other programming environment of their choice.

% end-of-term-examination:	60
% of continuous assessment (assigments, laboratory, practicals…):	40

BASIC BIBLIOGRAPHY

- S.B. Pope Turbulent Flows, Cambridge Univ. Press, 2000

ADDITIONAL BIBLIOGRAPHY

- H. Tennekes, J.L. Lumley A first course in turbulence, MIT Press, 1972

- P. A. Davidson Turbulence: An Introduction for Scientists and Engineers: An Introduction for Scientists and Engineers. , Oxford Univ. Press, 2004

- P. A. Durbin, B.P. Reif Statistical theory and modeling for turbulent flows., John Wiley & Sons., 2011

- Wilcox, D. C. Turbulence modeling for CFD , DCW industries, 1998