Liverpool John Moores University

Title:	Computational Fluid Dynamics
Status:	Definitive
Code:	**7004MSC** (121673)
Version Start Date:	01-08-2021
Owning School/Faculty:	Engineering
Teaching School/Faculty:	Engineering

Team	Leader
Mehdi Seddighi	Y
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Academic Level:	FHEQ7	**Credit Value:**	10	**Total Delivered Hours:**	33
Total Learning Hours:	100	**Private Study:**	67		

Delivery Options
Course typically offered: Semester 2

Component	Contact Hours
Lecture	11
Tutorial	22

Grading Basis: 50 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Test	AS1	Invigilated V.L.E test	40	
Report	AS2	CFD Project	60	

Aims

The module aims to explore the underlying theory of commercial computational fluid dynamics (CFD)
codes and to investigate their performance and reliability in engineering applications.

Whilst the theoretical aspects of the method will be covered in lectures the module is *intended to be practical in nature with students having the opportunity to practice via a range of tutorials and assignments using industry standard software.*

Learning Outcomes

After completing the module the student should be able to:

1 Set up and validate efficient and accurate CFD models of a range of simple engineering flows under steady and unsteady conditions.
2 Set up and validate an efficient and accurate CFD model of a complex flow (steady or unsteady) regime.
3 Critically evaluate the output from a CFD analysis.
4 Appreciate the theory underpinning commercial CFD codes.

Learning Outcomes of Assessments

The assessment item list is assessed via the learning outcomes listed:

Invigilated V.L.E test	1	4
CFD Project	2	3

Outline Syllabus

Introduction to CFD

Review the governing equations, N-S equations, continuity, and energy.
Methods for the discretisation of the governing equations.
Methods for handling advection/diffusion problems, upwinding etc.
Solving for pressure fields.
Application of boundary conditions.
The use of appropriate turbulence models in CFD. Time averaging and the modification of the N-S equations to predict the effects of turbulence (RANS).
Selection of appropriate turbulence model e.g. consideration of a number of different modelling approaches for example, Prandtl' mixing length model, k-epsilon model, Reynolds Stress Equation model, (RSM), Large Eddy Simulation (LES) methods.
Modelling of the boundary layer. Law of the wall and use of wall functions.
Basic iterative numerical methods for solving the discretised equations, use of relaxation, time steps etc.
Meshless techniques.
Critical analysis of CFD results, including errors and uncertainty in CFD calculations and meshing strategy.

Learning Activities

Lectures, tutorial/practical CFD sessions, case studies and assignments.

Notes

This module aims to appraise and distinguish the features of high performance CFD codes and introduces the student to some of the intricacies associated with the modelling of fluid flow using CFD. The module aims to develop in the student a critical approach towards the appraisal of CFD predictions.