Liverpool John Moores University

Title:	ADVANCED CFD
Status:	Definitive
Code:	**7025MAR** (115965)
Version Start Date:	01-08-2018
Owning School/Faculty:	Maritime and Mechanical Engineering
Teaching School/Faculty:	Maritime and Mechanical Engineering

Team	Leader
David Allanson	Y

Academic Level:	FHEQ7	**Credit Value:**	10	**Total Delivered Hours:**	36
Total Learning Hours:	100	**Private Study:**	64		

Delivery Options
Course typically offered: Semester 1

Component	**Contact Hours**
Lecture	12
Practical	24

Grading Basis: 50 %

Assessment Details

Category	Short Description	Description	Weighting (%)	Exam Duration
Test	AS1	Invigilated time limited Blackboard test.	50	
Report	AS2	Advanced CFD Project	50	

Aims

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

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:

Blackboard test	1	4
Advanced 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.

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 modeling of fluid flow using CFD. The module aims to develop in the student a critical approach towards the appraisal of CFD predictions.