



## Module Definition Form (MDF)

<b>Module code: MOD004046</b>	<b>Version: 2    Date Amended: 07/Feb/2023</b>
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<b>1. Module Title</b>
Computational Fluid Dynamics

<b>2a. Module Leader</b>
Ahad Ramezanzpour

<b>2b. School</b>
School of Engineering and the Built Environment

<b>2c. Faculty</b>
Faculty of Science and Engineering

<b>3a. Level</b>
7

<b>3b. Module Type</b>
Standard (fine graded)

<b>4a. Credits</b>
15

<b>4b. Study Hours</b>
150

<b>5. Restrictions</b>			
<b>Type</b>	<b>Module Code</b>	<b>Module Name</b>	<b>Condition</b>
Pre-requisites:	None		
Co-requisites:	None		
Exclusions:	None		
<b>Courses to which this module is restricted:</b>			

## LEARNING, TEACHING AND ASSESSMENT INFORMATION

6a. Module Description
<p>This module will provide you with a systematic, in-depth understanding and critical awareness of advanced fluid mechanics and numerical methods. The objectives of the module are to systematically develop in-depth knowledge, together with a practical understanding of how established techniques of research and enquiry can be used to create and translate knowledge to solve challenging problems in the discipline. It also develops the conceptual understanding of the subject that enables students to critically evaluate research and state of the art technology to create a critical awareness of current problems and to develop new vision, at the forefront of academic knowledge. Subjects covered during the module will include: errors, condition numbers and roots of equations; direct and iterative methods for linear systems; Navier-Stokes equation; finite differences for elliptic, parabolic and hyperbolic equations; Fourier decomposition, error analysis, and stability; high-order and compact finite-differences; finite volume methods; time marching methods; Navier-Stokes solvers; grid generation; finite volumes on complex geometries; finite element methods; spectral methods; boundary element and panel methods; turbulent flows; boundary layers; Lagrangian Coherent Structures. In a recent survey by Technavio, the global market for CFD is projected to grow at 16.5% per year.</p>

6b. Outline Content
<p>The governing equation of fluid dynamic The Finite Difference Method; Explicit and Implicit Discretisation Mathematical Behaviour of Partial Differential Equations. Errors and stability Turbulence modelling CFD Application</p>

6c. Key Texts/Literature
<p>The reading list to support this module is available at: <a href="https://readinglists.aru.ac.uk/">https://readinglists.aru.ac.uk/</a></p>

6d. Specialist Learning Resources
<p>Computational Fluid Dynamics software (such as Fluent).</p>

7. Learning Outcomes (threshold standards)		
No.	Type	On successful completion of this module the student will be expected to be able to:
1	Knowledge and Understanding	Formulate the fluid flow governing equations; explain the procedures involved in solving a complex computational fluid dynamics problem using mathematical and engineering principles.
2	Knowledge and Understanding	Illustrate a deep understanding of applications and limitations of computational fluid dynamics and future trends in the topic.
3	Intellectual, practical, affective and transferrable skills	Analyse a complex engineering problem in the area of fluid mechanics, apply appropriate computational techniques; critically analyse the results with particular emphasis on the limitations and scope of the study.
4	Intellectual, practical, affective and transferrable skills	Select and critically evaluate technical literature to solve a complex computational fluid dynamic problem and prepare a report.

8a. Module Occurrence to which this MDF Refers				
Year	Occurrence	Period	Location	Mode of Delivery
2025/6	ZZF	Template For Face To Face Learning Delivery		Face to Face

8b. Learning Activities for the above Module Occurrence			
Learning Activities	Hours	Learning Outcomes	Details of Duration, frequency and other comments
Lectures	12	1-2	1 hour lecture per week.
Other teacher managed learning	24	3-4	2 hours computer lab workshop
Student managed learning	114	1-4	Independent self-study and research
TOTAL:	150		

9. Assessment for the above Module Occurrence					
Assessment No.	Assessment Method	Learning Outcomes	Weighting (%)	Fine Grade or Pass/Fail	Qualifying Mark (%)
010	Coursework	1 3 4	80 (%)	Fine Grade	40 (%)
<b>Course work. A case study based assignment of max 2000 words (maps to Engineering Council Learning Outcomes M1, M3, M4)</b>					
Assessment No.	Assessment Method	Learning Outcomes	Weighting (%)	Fine Grade or Pass/Fail	Qualifying Mark (%)
011	Practical	2	20 (%)	Fine Grade	40 (%)
<b>Oral presentation. 10 minutes oral presentation including Q&amp;A (maps to Engineering Council Learning Outcomes M1, M3)</b>					

In order to pass this module, students are required to achieve an overall mark of 40% (for modules at levels 3, 4, 5 and 6) or 50% (for modules at level 7\*).

In addition, students are required to:

(a) achieve the qualifying mark for each element of fine graded assessment as specified above

(b) pass any pass/fail elements

[\* the pass mark of 50% applies for all module occurrences from the academic year 2024/25 – see Section 3a of this MDF to check the level of the module and Section 8a of this MDF to check the academic year]

