

## MODULE DESCRIPTOR

### Module Title

Advanced Thermofluids

Reference	EN5501	Version	7
Created	March 2023	SCQF Level	SCQF 11
Approved	March 2004	SCQF Points	15
Amended	August 2023	ECTS Points	7.5

### Aims of Module

To establish competence in the theory and practice of Fluid Mechanics and Computational Fluid Dynamics, particularly applied to the energy industries.

### Learning Outcomes for Module

On completion of this module, students are expected to be able to:

- 1 Appraise advanced concepts related to complex flow systems, boundary layers, turbulence and thermofluids properties.
- 2 Evaluate various analytical and numerical analysis techniques for solving complex fluid dynamics problems.
- 3 Analyse thermal processes by synthesising basic principles of Finite Element analysis for heat transfer applications.
- 4 Construct CFD models for complex fluid flow and heat transfer problems evaluating the effectiveness of the methods used.

### Indicative Module Content

Fundamentals of Fluid Mechanics: the conservation laws and their application, viscosity/rheometry and the constitutive equations, boundary layers, turbulence and thermofluid properties. Computational Fluid Dynamics. Overview of discretisation methods: Finite Difference, Finite Element, Finite Volume. Boundary layers, turbulence models, compressible flows, flows with heat transfer. Validation of CFD. Applications taken from (but not limited to): aerodynamics, atmospheric (wind energy), oceanic flows (wave energy), open and closed channel flow (tidal energy), oil & gas industry (tubulars and process plant), aquifers (oil & gas, water, geothermal), industrial hydraulics and pneumatics.

### Module Delivery

The module will be delivered by means of lectures and tutorials supporting CFD laboratories and practical work. Academic and industrial seminars will be held when possible.

**Indicative Student Workload**

	Full Time	Part Time
Contact Hours	48	N/A
Non-Contact Hours	102	N/A
Placement/Work-Based Learning Experience [Notional] Hours	N/A	N/A
TOTAL	150	N/A
<i>Actual Placement hours for professional, statutory or regulatory body</i>		

**ASSESSMENT PLAN**

If a major/minor model is used and box is ticked, % weightings below are indicative only.

**Component 1**

Type: Coursework Weighting: 100% Outcomes Assessed: 1, 2, 3, 4

Description: A report after solving a practical thermofluid problem using numerical techniques.

**MODULE PERFORMANCE DESCRIPTOR****Explanatory Text**

Component 1 comprises of 100% of the module grade. To pass the module, a D grade is required.

Module Grade	Minimum Requirements to achieve Module Grade:
<b>A</b>	A
<b>B</b>	B
<b>C</b>	C
<b>D</b>	D
<b>E</b>	E
<b>F</b>	F
<b>NS</b>	Non-submission of work by published deadline or non-attendance for examination

**Module Requirements**

Prerequisites for Module Plant Performance (EN4700) or equivalent

Corequisites for module None.

Precluded Modules None.

**INDICATIVE BIBLIOGRAPHY**

- 1 VERSTEEG, H. and MALALASEKERA, W., 2007, An introduction to computational fluid dynamics-The finite volume method, 2nd ed. Harlow:Pearson
- 2 FERZIGER, JOEL H and MILOVAN PERIC., 2002. Computational methods for fluid dynamics. 3rd ed. Berlin: Springer.
- 3 CFD online documentation.