Module Title **Advanced Thermofluids** **Keywords** Thermofluids, Computational Fluid Dynamics, CFD, rheometry, turbulence, boundary layers, compressible flows, heat transfer, discretisation methods, finite volume method	Reference EN5501 SCQF SCQF Level 11 SCQF Points 15 ECTS Points 7.5 Created January 2004 Approved March 2004 Amended July 2012 Version No. 3

This Version is No Longer Current

The latest version of this module is available here

Prerequisites for Module

Plant Performance (EN4700) or equivalent

Corequisite Modules

None.

Precluded Modules

None.

Aims of Module

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

Applications taken from (but not limited to): lubrication, aerodynamics, atmospherics (wind energy), oceanic flows (wave energy), open and closed channel flow (tidal energy), oil & gas industry (tubulars and process plant) , acquifers (oil & gas, water, geothermal), industrial hydraulics and pneumatics.

Indicative Student Workload

Contact Hours	Full Time	Part Time
Assessment	2	2
Laboratories	18	18
Lectures	12	12
Seminars	2	2
Tutorials	6	6
Directed Study		
Self-study/coursework	36	36

Learning Outcomes for Module

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

1. Explain fundamental concepts related to the conservation laws of fluid dynamics and their applications, boundary layers, turbulence and thermofluids properties
2. Solve governing equations of fluid dynamics using various analytical techniques
3. Demonstrate competence in using state of the art CFD software for solving fluid flow and heat transfer problem
4. Use CFD software for solving complex fluid flow and heat transfer problems and provide analysis of results

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.

Comptational Fluid Dynamics. Overview of

Private Study

Private Study	74	74

Mode of 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.

Assessment Plan

	Learning Outcomes Assessed
Component 1	1,2
Component 2	3
Component 3	4

Component 1 is a coursework which involves an in-class test (20% weighting)

Component 3 is a coursework which involves submitting a report after completing a CFD analysis of a specified problem (50% weighting)

Component 2 is a coursework which involves submitting a report containing reflective statement on completed CFD tutorials (30% weighting)

discretisation methods: FD, FE, FV etc.. The finite volume method of discretisation. Newtonian and non-Newtonian flows, boundary layers, turbulence, compressible flows, flows with heat transfer. Validation of CFD.

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.