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MODULE DESCRIPTOR

Module Title

Advanced Thermofluids			
Reference	EN5501	Version	5
Created	September 2021	SCQF Level	SCQF 11
Approved	March 2004	SCQF Points	15
Amended	September 2021	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	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 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. 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.

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
Actual Placement hours for professional, statutory or regulatory body		

ASSESSMENT PLAN

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

Component 1

Type:	Coursework	Weighting:	20%	Outcomes Assessed:	1, 2
Description:	In-class test.				

Component 2

Type:	Coursework	Weighting:	30%	Outcomes Assessed:	3
Description:	A written reflective statement based on CFD simulations.				

Component 3

Type:	Coursework	Weighting:	50%	Outcomes Assessed:	4
Description:	A six page report after solving a practical thermofluid problem using a CFD code.				

MODULE PERFORMANCE DESCRIPTOR

Explanatory Text

To pass the module the student must achieve a minimum of a grade D. Non-submission of any component will result in an NS grade.

Module Grade	Minimum Requirements to achieve Module Grade:
A	A in Component 3 and at least B in remaining components.
B	A in Component 3 and at least D in remaining components OR B in Component 3 and at least C in remaining components.
C	C in Component 3 and at least D in remaining components OR D in Component 3 and at least A and D, or B and C in remaining components.
D	D in Component 3 and at least D in remaining components.
E	E in one or more components.
F	F in one or more components.
NS	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.