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MODULE DESCRIPTOR

Module Title

Plant Performance			
Reference	EN4700	Version	3
Created	July 2017	SCQF Level	SCQF 10
Approved	March 2004	SCQF Points	15
Amended	August 2017	ECTS Points	7.5

Aims of Module

To provide the student with the ability to apply the heat, mass and momentum transfer mechanisms to plant performance.

Learning Outcomes for Module

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

1	Apply compressible flow principles to duct flows and analyse the behaviour of relief and blowdown systems in process plant and pipeline equipment.
2	Apply heat, mass and momentum transfer principles to the design of heat exchangers, combustion systems and energy transfer processes.
3	Explain 2 and 3 dimensional numerical modelling of thermal processes and basic principles of FE analysis for heat transfer.
4	Discuss the mechanisms and significance of membrane processes and evaluate their role in developing alternative fuels and energy systems.

Indicative Module Content

Compressible flow in ducts, nozzles and valves, choked flows, blowdown and relief systems; hazard analysis and safety cases, application to pipeline operation and process plant, external flows. Principles of chemical thermodynamics and application to energy changes in combustion systems; adiabatic flame temperatures, effects of mixture strength, dissociation and pressure. Lean-burn and low-emissions systems. Introduction to mass transfer principles; application to steady-state and transient systems, combined heat and mass transfer, combustion of liquid fuels in IC engines and gas turbines, partial condensers. Membrane processes; application to gas purification, fuel processing, fuel cells, reactors and gas production. Analogies between heat, mass and momentum transfer and their application to equipment design. Two and three dimensional numerical modelling of heat transfer processes. Basic finite element analysis theory and practice applied to heat transfer problems. Alternative fuels, waste minimisation and process integration, process intensification; pinch technology, optimisation of heat exchanger networks.

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Module Delivery

The module will be delivered by means of lectures and tutorials and student-centred learning.

Indicative Student Workload	Full Time	Part Time
Contact Hours	50	50
Non-Contact Hours	100	100
Placement/Work-Based Learning Experience [Notional] Hours	N/A	N/A
TOTAL	150	150
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:	30%	Outcomes Assessed:	3
Description:	Investigation and report.				

Component 2

Type:	Examination	Weighting:	70%	Outcomes Assessed:	1, 2, 4
Description:	Closed book examination.				

MODULE PERFORMANCE DESCRIPTOR

Explanatory Text

To pass the module students must achieve at least a grade D overall AND a minimum of 35% in the coursework and examination.

Module Grade	Minimum Requirements to achieve Module Grade:
A	70% and above
B	60-69%
C	50-59%
D	40-49%
E	35-39%
F	34% and below
NS	Non-submission of work by published deadline or non-attendance for examination

Module Requirements

Prerequisites for Module	Industrial Plant (EN3700) or equivalent.
Corequisites for module	None.
Precluded Modules	None.

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INDICATIVE BIBLIOGRAPHY

1	KAYS, W.M. AND CRAWFORD, M., 1993. Convective Heat and Mass Transfer. 3rd ed. New York: McGraw Hill.
2	TREYBAL, R., 1980. Mass Transfer Operations. 3rd ed. New York: McGraw Hill.
3	CENGEL, Y.A., 2004. Heat Transfer: A Practical Approach. 2nd ed. New York: McGraw-Hill.
4	KAUSHIK, M., 2019, Theoretical and Experimental Aerodynamics. Springer Nature Singapore.