Module Title **Plant Performance** **Keywords** Compressible flow, mass transfer, combustion systems, membrane processes, 2-D and 3-D thermal conduction, heat exchangers	Reference EN4700 SCQF Level SCQF 10 SCQF Points 15 ECTS Points 7.5 Created July 2002 Approved March 2004 Amended August 2011 Version No. 2

This Version is No Longer Current

The latest version of this module is available here

Prerequisites for Module

Industrial Plant (EN3700)

Corequisite Modules

None.

Precluded Modules

None.

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

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.

Indicative Student Workload

Contact Hours	Full Time	Part Time
Lectures	24	24
Tutorials	12	12

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

Directed Study		
Directed self-study/Courswork preparation	30	30
Private Study		
Private Study	84	84

Mode of Delivery

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

Assessment Plan

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

Component 2 is a closed book examination (70% weighting).

Component 1 is a coursework investigation and report based on use of numerical methods (30% weighting).

Indicative Bibliography

1. KAYS, W.M. AND CRAWFORD, M., 1993. Convective Heat and Mass Transfer. 3rd ed. New York: McGraw Hill.

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.

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.