

## PROCESS INTENSIFICATION MODULE A Short Description

### Objectives

Process Intensification Module deals with some principles, technologies, methods and tools for process efficiency improvement.

To that effect, we will exploit the material of the corresponding HW module. In addition, we will try to extend the module in Process and Systems Optimisation issues and highlight tools (software tools, methods etc.) and applications.

### Subjects

#### Content

Process intensification may be defined as: **“Any engineering development that leads to a substantially smaller, cleaner, safer and more energy efficient technology.”**

Process intensification is an area of technology spanning a wide range of industrial sectors, and extending from the process industries to commercial and domestic equipment and components. Often associated with chemical plant, where the reduced inventory of hazardous materials in intensified plant is a major safety bonus, the concept has much wider implications.

Process intensification is one of the important business opportunities of the 21st Century. It could radically change manufacturing of many commodities, allowing local production in small, safe plants - even at supermarket level! It has major implications for sectors such as food & drink, chemicals, oil & gas, and power generation & distribution. Comparing the technology with micro-electronics, we are already looking at the 'plant on a chip'.

Students with an interest in new technologies, and an ability to see how these may be integrated into what are often conservative industrial sectors, will find this module particularly useful.

### Subjects

PI Module includes, amongst others, the following:  
Process Intensification-

#### Generic Application Area

- Definition and main implications of Process Intensification (PI) principles
- Benefits and Perceived limitations
- Types of Intensified Processes
- Main technologies and tools for PI (PI audits)
- Specifying, Manufacturing and Operating PI Plant
- Applications of PI principles in:
  - Heat Transfer

- Energy Saving
- Safety
- Applications of PI in various types of industry
- (Power generation, Refineries, Food industry,
- Process and systems optimisation:
- Methods and tools in Process and Systems Optimisation

By studying PI, one of the main benefits will be the ability to identify the parameters that may affect the efficiency of a system's operation, for example the size, the technology, the materials being used, as well as the methods to improve this efficiency.

To achieve the above we will try to provide as many examples, case studies, design studies and analysis of the decision-making process.

Furthermore, we will identify an easy to use optimisation software and make some useful presentations on its use.

### Module Assessment

Assessed by submitted assignment and written examination.

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## WHAT IS PROCESS INTENSIFICATION?

- "Any (chemical) engineering development that leads to a **substantially smaller, cleaner, safer and more energy-efficient technology**"
- The 'HiGee' rotating distillation column of Colin Ramshaw/ICI
- Micro-reformers for fuel cells for mobile phones
- The mobile phone itself has been intensified! Massive volume reductions in the last decade



## IN PRACTICE THIS CAN MEAN:

### Off-shore rotating packed bed separator plant

Parameter	Existing Technology	Rotating Bed Technology
Investment	1.0	<b>0.6</b>
Power consumption	1.0	<b>0.8</b>
Plant 'footprint'	1.0	<b>0.2</b>
Weight	1.0	<b>0.1</b>
Plant height	1.0	<b>0.1</b>

Unit on r.h.s is sea-water deaerator of 6000 t/d capacity - China

