

# ES2E4-15 Reaction Engineering Principles

**22/23**

**Department**

School of Engineering

**Level**

Undergraduate Level 2

**Module leader**

Andre van Veen

**Credit value**

15

**Module duration**

10 weeks

**Assessment**

30% coursework, 70% exam

**Study location**

University of Warwick main campus, Coventry

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## Description

### Introductory description

ES2E4-15 Reaction Engineering Principles

[Module web page](#)

### Module aims

- Introduce concepts in chemical reaction engineering in view of application to chemical process technology.
- Develop a firm understanding of the principles of stoichiometric (mass balance), chemical thermodynamics and kinetic (rate expressions) considerations as prerequisite for mathematical description of chemical conversion and process integrated reactor design.
- This module also equips students with the fundamental skills required to perform a 3rd year individual project in the field of chemical engineering.

### Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be

covered. Actual sessions held may differ.

Formalisms in the mathematical description of a chemical reaction at industrial scale  
Chemical kinetics of homogeneous and heterogeneous reactions (catalysis) - Micro kinetics  
(Quantitative) description of adsorption phenomena  
Mass transport in a multiple phase system - Macro kinetics  
Ideal reactor models and simplified design of reaction devices  
Impact of residence time distribution on reactor performance – Real reactors

## Learning outcomes

By the end of the module, students should be able to:

- Confidently identify appropriate rate expressions in chemical kinetics based on stoichiometry and reaction network type
- Perform the mathematical description of adsorption and desorption processes
- Compare and contrast the concepts of micro and macro kinetics
- Recognize the impact of the residence time distribution on reactor performance and choose appropriate models for given real-life reactor problems
- Specify the system of differential equations allowing the mathematical description of a reaction
- Evaluate constraints in chemical reactor design
- Evaluate simplifications in applied models causing imperfection in predictions.

## Indicative reading list

O. Levenspiel, "Chemical reaction engineering 3rd edition", John Wiley & Sons Inc. (1999)  
J.M. Thomas, W.J. Thomas, "Principles and practice of heterogeneous catalysis", VCH (1997)

## Subject specific skills

Micro kinetic description of complex homogeneous or heteroge

## Transferable skills

Use of fundamental principles to build mathematical models describing real system behaviour at acceptable precision

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## Study

## Study time

Type	Required
Lectures	10 sessions of 3 hours (20%)
Total	150 hours

<b>Type</b>	<b>Required</b>
Seminars	1 session of 1 hour (1%)
Practical classes	4 sessions of 1 hour (3%)
Other activity	3 hours (2%)
Private study	112 hours (75%)
Total	150 hours

### **Private study description**

112 hours Guided independent learning

### **Other activity description**

2 hours Example classes (2 x 1 hour)

1 hour Revision/Examination advice class

### **Costs**

No further costs have been identified for this module.

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### **Assessment**

You must pass all assessment components to pass the module.

### **Assessment group D4**

	<b>Weighting</b>	<b>Study time</b>
Laboratory assignment report	30%	
Laboratory assignment report based on either completing a template (limited to 6 pages) or filling the appropriate sections in an online interface (effort comparable to template option). Acquired data must be joined in appropriate tables (cf. lab instruction sheet).		
Online Examination	70%	
QMP online examination		
~Platforms - AEP,QMP		

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- Online examination: No Answerbook required
- Students may use a calculator
- Graph paper

## Feedback on assessment

Support through advice and feedback hours.

Written feedback on marked laboratory assignment.

Cohort-level feedback on formative multiple choices test.

Cohort-level feedback on final exam.

[Past exam papers for ES2E4](#)

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## Availability

### Courses

This module is Optional for:

- Year 2 of UESA-H113 BEng Engineering
- Year 2 of UESA-H315 BEng Mechanical Engineering
- UESA-H112 BSc Engineering
  - Year 2 of H112 Engineering
  - Year 2 of H112 Engineering
- Year 2 of UESA-H114 MEng Engineering
- Year 2 of UESA-H316 MEng Mechanical Engineering