ES2E4-15 Reaction Engineering Principles

23/24

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

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

Type	Required
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.

Assessment

You must pass all assessment components to pass the module.

Assessment group D4

	Weighting	Study time
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

- 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

Availability

Courses

This module is Optional for:

- Year 2 of UESA-H315 BEng Mechanical Engineering

This module is Option list A for:

- Year 2 of UESA-H113 BEng 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