ES2E4-15 Engineering Reactors for Sustainable Processes

24/25

Department
School of Engineering
Level
Undergraduate Level 2
Module leader
Andre van Veen
Credit value
15
Module duration
10 weeks
Assessment
100% coursework
Study location
University of Warwick main campus, Coventry

Description

Introductory description

ES2E4-15 Engineering Reactors for Sustainable Processes

Module web page

Module aims

- Introduce concepts and example cases in chemical reaction engineering in view their application in sustainable process technology.
- Develop a firm understanding of the principles of stoichiometric, thermodynamic and kinetic considerations to enable the quantitative description of chemical conversions.
- Use of mass balance, chemical rate expressions and residence time characteristics for reactor design in integrated greener processes.
- 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.

Quantitative description of a chemical reaction at industrial scale.
Engineering description of adsorption and desorption phenomena.
Sustainable concepts like catalysis and their impact on reactor design.
Ideal reactor models and simplified design of reaction devices.
Impact of residence time distribution on reactor performance.
Heat management in chemical reactors.

Learning outcomes

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

- Confidently identify and solve appropriate equations in chemical kinetics based on stoichiometry and reaction network type [C1, C2, M1, M2]
- Quantitative description of adsorption and desorption processes leading to sustainable concepts like catalysis [C2, M2]
- Recognize the impact of the residence time distribution on reactor performance and choose appropriate models for given real-life reactor problems [C3, M3]
- Evaluate constraints in sustainable chemical reactor design [C13, M13]
- Evaluate simplifications in applied models causing imperfection in predictions. [C4, C12, M4, M12]

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)
H. Scott Fogler, "Essentials of chemical reaction engineering", International ed., Pearson Education Int. (2011)

Interdisciplinary

This module covers major aspects of chemical engineering. It has an interdisciplinary aspect being placed in engineering but making use of concepts developed in chemistry and physics.

Subject specific skills

Kinetic description of complex chemical reactions in view of reactor design.
Aspects of sustainability in chemical engineering.

Transferable skills

Use of fundamental principles to build mathematical models describing real system behaviour.
Critical evaluation of model simplifications in view of attaining an acceptable precision in predictions.

Study

Study time

Type	Required
Lectures	30 sessions of 1 hour (20%)
Seminars	1 session of 1 hour (1%)
Practical classes	1 session of 4 hours (3%)
Other activity	3 hours (2%)
Private study	112 hours (75%)
Total	150 hours

Private study description

112 hours of 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 A

	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).

Report on Chemical Engineering design task	70%	

Individual report providing a detailed description on how a specific design case set as assignment case was addressed. The candidate is supposed producing a concise document proving insight

	Weighting	Study time

to the underpinning theory, adapted strategy, working on the design and discussion on the pros and cons of a suggested solution.

Feedback on assessment

Support through advice and feedback hours.
Written feedback on marked laboratory assignment.
Cohort-level feedback on formative multiple choices test.
Written feedback on marked essay assignment.

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