

Name

First name.....

Student number

Signature

**M.Sc. COURSE ON PROCESS INTENSIFICATION
EXAMINATION FORM**

Maximum score: 100 pts

Questions:

Generic principles of Process Intensification

(20 pts)

Giving each molecule the same processing experience presents one of the generic principles of Process Intensification.

Provide 4 examples of PI-technologies that, at least partially, address that principle. Motivate (briefly) your choices.

Structure

(20 pts)

In fine chemical and pharmaceutical processes batch-operated, stirred-tank reactors are traditionally applied. Microreactors are nowadays becoming a possible alternative for many such processes. Give (briefly, in bullets) 3 pro's and 3 con's of microreactors in comparison with the conventional stirred tank reactors.

	Microreactors	Stirred-tank reactors
Pro's	<ul style="list-style-type: none">•••	<ul style="list-style-type: none">•••
Con's	<ul style="list-style-type: none">•••	<ul style="list-style-type: none">•••

Structure

(15 pts)

The random system – trickle-bed reactor – can be replaced by a structured system, e.g. the monolithic reactor. Compare the advantages and disadvantages of both systems by filling in the table below

	Trickle-Bed Reactor	Monolithic Reactor
Utilisation of catalyst volume (effectiveness factors)		
Local hot-spot creation		
Specific area for mass transfer		
Pressure drop		
Scale-up		
Possibility for realization of long residence times		

Energy

(15 pts)

Compare (qualitatively: - -; -; 0; +; ++) the Rotating Packed Bed and Spinning Disc Reactors on the following aspects:

- mass transfer,
- heat removal,
- maximum production capacity,
- pressure drop,
- operations with viscous media,
- operations in which precipitation occurs.

	Spinning Disc Reactor	Rotating Packed Bed
Mass transfer		
Heat removal		
Max production capacity		
Pressure drop		
Viscous media		
Precipitation in the system		

Synergy

(15 pts)

Name and describe 5 different roles that membrane can play in a chemical (catalytic) reactor.

Time

(15 pts)

Purposeful oscillations present an example of the PI approach in the temporal domain. The so-called Oscillatory (Baffle) Flow Reactor is based on the above approach.

Explain how OBFR operates and name its most important feature (advantage).
To which category of chemical reactions the OBFR is particularly suitable?