

BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI, PILANI CAMPUS
CHEMICAL ENGINEERING DEPARTMENT
COMPREHENSIVE EXAMINATION

Course Title: Process Intensification
Book

Nature of Exam: Closed

Course No.: CHE G620

Date: 07/12/2016

Marks: 80

Time: 3 hr

1. (3+3+3+3 = 12 Marks)

- (a) Discuss the advantages of Divided Wall Column (DWC) over conventional distillation columns.
- (b) Briefly discuss the various operational issues associated with the DWC.
- (c) Represent and describe the different configurations of DWC for the separation of three component mixture.
- (d) How is the combination of DWC with reactive distillation advantageous in the hydrolysis of methyl acetate process over the conventional reactive distillation?

2. (4+3+5 = 12 Marks)

- (a) Which parameters are required to be varied for effective optimization of thermal and hydraulic requirements of heat exchangers?
- (b) Discuss the advantages and applications of helical coil heat exchangers.
- (c) Which properties of nanoparticles should be considered for their application as nano-fluids? How do the use of nano-fluids improve the heat exchanger performance?

3. (4+3+3 = 10 Marks)

- (a) Describe in details the different types of membrane distillation configurations to separate aqueous feed solution using a microporous hydrophobic membrane.
- (b) Discuss the effect of Liquid Entry Pressure (LEP) and membrane porosity & tortuosity on the performance of membrane distillation process.
- (c) What is temperature polarization and concentration polarization phenomena in membrane distillation? Also discuss their respective effects on membrane distillation process.

4. (3+3+4 = 10 Marks)

- (a) List down the benefits obtained from the intensifying processes by using multifunctional catalysts.
- (b) What is the Marangoni effect? Discuss with respect of multifunctional reactors.
- (c) Monolithic catalysts act as an alternative to processes based on slurry reactor technology. Justify this statement.

5. (5 Marks)

List down the parameters affecting the thermal conductivity of nano-fluids. Why is it difficult to measure the thermal conductivity of nano-fluids?

6. (5+5 = 10 Marks)

- (a) Explain the working principle of Oscillatory Baffled Reactor (OBR). Discuss the three different types of baffle design used in OBR.
- (b) In the Enzymatic saccharification of alpha-cellulose, the activity of cellulase is reduced over the time thus reducing the reaction rate. List down the reasons for reduction in

reaction rate and how these issues can be overcome by use of Oscillatory Baffled Reactor (OBR).

7. (3+4+4 = 11 Marks)

- (a) Which are two different techniques for the fabrication of Printed Circuit Heat Exchangers (PCHE)? Discuss briefly.
- (b) Discuss various fluid flow paths possible in PCHE. How will you overcome the problem of pressure drop in PCHE?
- (c) Which issues could be addressed with the use of PCHE in reactors for heterogeneous catalytic processes?

8. (5+5 = 10 Marks)

- (a) How does the use of Spinning Disk Reactor (SDR) intensify the polymerization process? Also list down the benefits of SDR technology over other methods used in polymerization process.
- (b) Discuss the advantages and disadvantages of various methods used for the production of TiO₂ nanoparticles. Why is SDR considered as more suitable method?

ALL THE BEST