

**Birla Institute of Technology and Science, Pilani – Pilani Campus**

**Semester-II, 2022-23**

**CHE G641: Reaction Engineering**

**Mid-semester Examination (Regular)**

**Date: 13/03/2023**

**Wt%: 35**

**Duration: 1.5 Hours**

**Instructions:** 1) Attempt all questions; 2) Take suitable assumptions wherever necessary.

**Closed Book (Max. Marks: 25)**

- Q.1.** Discuss the effect of early, and late maxing for macro and microfluids with the help of suitable reactor (Plug flow, Mixed flow) examples. What is the significance of order of reaction in reactor (Plug flow, Mixed flow) arrangement/configuration in the light of above? [4]
- Q.2.** Give an example of a Gas-Liquid reaction. Suggest a reactor (name) which you will use for this reaction, justify your choice. Also, draw the concentration profile for the same with detailed explanation. [5]
- Q.3.** Give three examples in the following categories of Gas-Solid reactions, with their industrial significance: (i) Catalytic, and (ii) Non-catalytic. [6]
- Q.4.** Derive an expression for *time* as a function of *conversion* using shrinking core model for type D reaction. [10]

**Open Book (Max. Marks: 10)**

- Q.5.** A solid feed consisting of: [10]  
30 wt% of 1 mm particles and smaller  
40 wt% of 2 mm particles  
30 wt% of 5 mm particles  
passes through a rotating tubular reactor similar to a cement kiln where it react with gas to give a hard sturdy solid product. Assume Shrinking Core Model with reaction control is applicable,  $\tau = 4$  hour for 5 mm particles.  
a) Find the residence time needed for 100% conversion of solids.  
b) Find the mean conversion of the solids for a residence time of 15 min.

\*\*\*Best Wishes\*\*\*