Register No.: .... Name: ....

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

SEVENTH SEMESTER B. TECH DEGREE EXAMINATION (S), FEBRUARY 2024
CHEMICAL ENGINEERING
(2020 SCHEME)

Course Code : **20CHT471**

Course Name: **Fluidization Engineering**

Max. Marks : **100** **Duration: 3 Hours**

Missed data may be assumed suitably.
Use of Photostat copies of the fluidization charts duly attested by the concerned faculty shall be permitted in the exam hall.

PART A

(Answer all questions. Each question carries 3 marks)

1. Inspect the effect of temperature and pressure on fluidization quality.
2. Show the liquid like behavior of solids during fluidization using diagrams.
3. Define sphericity of a particle and how it affects fluidization.
4. Write the equation for power consumption in a fluidized bed column.
5. Give a short note on bubble rise velocity.
6. Differentiate between coalescence and splitting.
7. List out any three applications of fluidized bed based on heat transfer.
8. Define Sherwood number and its significance.
9. Highlight any three factors considered during the design of catalytic reactors.
10. Mention the optimum size ratio equation of reactor and regenerator.

PART B

(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. Explain the fluidized catalytic cracking of oil using riser cracking unit and Kellogg's unit with neat sketches. (14)

OR

12. Illustrate any two units of multistage fluidized adsorption for the removal of toxic components from gas mixture using activated carbon. (14)

MODULE II

13. a) Enumerate the effect of gas velocity on the pressure drop of fluidized bed for small even sized particles using a neat sketch. (7)

    b) Design a perforated plate distributor for a fluidized bed reactor with gas pressure p_0 = 3 bar (abs.) and u_0 = 40 m/s. (7)
    Data: d_t = 4 m, L_{mf} = 2 m, ε_{mf} = 0.48, ρ_s = 1500 kg/m^3, ρ_g = 3.6 kg/m^3, $\mu_g = 2\times10^{-5}$ Pa.s

OR

14. a) Explain the Geldart classification of particles. (7)

    b) Predict the mode of fluidization for particles of density ρ_s = 1.5 g/cm^3 at superficial gas velocities of u_0 = 40 cm/s and 80 cm/s. (7)
    Data: d_p = 60 μm, ρ_g = 1.5 kg/m^3, μ_g = 2×10^{-5} Pa.s.

MODULE III

15. Explain the Davidson model for gas flow at bubbles in a fluidized bed using neat diagrams. (14)

OR

16. Describe the K-L flow model with its Davidson bubbles and wakes using neat sketches. (14)

MODULE IV

17. a) Derive an expression for dimensionless mass transfer coefficient using bubbling bed model. (7)

    b) Illustrate the effect of Reynolds number on the dimensionless heat transfer coefficient in fluidized bed. (7)

OR

18. a) Write a short note on the effect of adsorption on inter-exchange coefficient. (7)

    b) Derive an expression for the dimensionless heat transfer coefficient in bubbling bed. (7)

MODULE V

19. Analyze the important factors considered during the design of fluidized bed columns for batch operations in (14)
    i) Heat transfer.
    ii) Mass transfer.

OR

20. Derive the shrinking core kinetic model and Thiele modulus for the conversion of solids. (14)

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