B. Tech.
(SEM. VIII) THEORY EXAMINATION 2011-12
FLUIDIZATION ENGINEERING

Time : 3 Hours Total Marks : 100

Note :— (1) Attempt all questions.
(2) All questions carry equal marks.
(3) Assume suitable data, if missing.

1. Attempt any four parts of the following :— (5x4=20)

(a) What is fluidization? Write its importance in chemical process industries.
(b) Differentiate between particulate fluidization and aggregative fluidization.
(c) Explain the concept of minimum fluidization.
(d) Define superficial and terminal velocity of the particles.
(e) What are pneumatic conveyors? Write its applications in process industries.
(f) Describe the positive pressure pneumatic conveyors with a neat diagram in brief.

2. Attempt any two parts of the following :— (10x2=20)

(a) Oil of specific gravity 0.9 and viscosity 3 mNs/m² passes vertically upwards through a bed of catalyst consisting of approximately spherical particles of
diameter 0.1 mm and specific gravity 2.6. At approximately what mass rate of flow per unit area of bed will fluidization occur?

(b) A catalyst having spherical particles of $D_p = 50$ microns and $\rho_s = 1.65 \text{ g/cm}^3$ is to be used to contact a hydrocarbon vapour in a fluidized reactor at 900 °F, 1 atm pressure. At rest the bed has a porosity of 0.35 and a height of 3 ft. At operating conditions, the fluid viscosity is 0.02 centipoise and its density is 0.21 lb/ft³. Determine the superficial gas velocity necessary to fluidize the bed, the velocity at which the bed would begin to flow with the gas, and the extent of bed expansion when the gas velocity is the average of the velocities previously determined. The porosity at minimum fluidization velocity is 0.42. Does aggregative of particulate fluidization occur?

(c) Describe the properties of bubbles in the bed.

3. Attempt any two parts of the following :— (10×2=20)
   (a) Describe heat transfer characteristics of liquid-solid fluidized system in brief.
   (b) Describe the mass transfer phenomena between fluid and particles.
   (c) What is fluidized bed catalytic cracking? Write its application in the chemical industries.

4. Attempt any two parts of the following :— (10×2=20)
   (a) Describe in brief the fluid-solid conveying and pneumatic conveying. What do you understand from choking point?
   (c) What is high velocity fluidization? Mention the significance of pressure drop in turbulent and fast fluidization.

5. Write short notes on any four parts of the following :— (5×4=20)
   (a) Spouted beds
   (b) Slug flow
   (c) Effect of fluid velocity on pressure gradient
   (d) Fluidized bed combustion
   (e) Bed porosity
   (f) Interaction and coalescence of bubbles.