CODE NO: OR 3105861 OR

2005 JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY

III B.TECH I SEMESTER SUPPLEMENTARY EXAMINATIONS
MECHANICAL UNIT OPERATIONS
(CHEMICAL ENGINEERING)

/APRIL/MAY 2005

TIME: 3 HOURS
MAX MARKS: 70

Answer any FIVE Questions
All Questions carry equal marks

1. (a) For °ow of solids out of a bin which opening is preferable, side opening or a bottom opening? Why?

(b) What are the factors on which the rate of °ow of granular solids by gravity, through a circular opening in the bottom of a bin, depends upon?

(c) Discuss about various devices for transportation of solids.

2. (a) Distinguish between kneaders, dispersers and masticators.

(b) Describe with ¯gures double-motion paste mixers.

3. (a) 3.0 kW has to be supplied to a material crushing at the rate of 0.3 kg/s from 12.5 mm cubes to a product of 3.1 mm. What would be the rate at which same material should be supplied to the machine if its power consumption remains same to get the product of 2 mm cube?

(b) What is volume surface mean diameter of particles? Give its expression.

4. (a) Explain the working of plate and frame ¯lterpress with a neat diagram.

(b) Discuss about shell-and-leaf ¯lters.

5. A tubular membrane with a diameter of 2 cm and a water permeability of 250 L/m2-h-atm is being used for UF of cheese whey. The whey proteins have an average di®usivity of 4 £ 10¡7 cm2/s and the osmotic pressure in atmospheres is given by Jonsson's equation: ¼ = 4:4 £ 10¡3c ¡ 1:7 £ 10¡6c2 + 7:9 £ 10¡8c3 where c is the protein concentration in grams per liter. Calculate the e®ect of ¢p on the °ux for a clean membrane if the solution velocity is 1.5 m/s and the protein concentration is 10, 20 or 40 g/L. Assume the gel concentration is 400 g/L and the rejection is 100 percent. Assume the bulk solutions have the same density and viscosity as water: ½=1 g/cm3 ¹=0.01 g/cm-s

6. (a) Discuss di®erential settling method and obtain the relation between diameters and densities of two di®erent density particles.

(b) Write a note about clari¯ers and thickeners.

7. (a) With neat sketch explain the construction and working principle of Jet Mixers.

(b) A pilot-plant vessel 305 mm in diameter is agitated by a six-bladed turbine impeller 102 mm in diameter. When the impeller Reynolds number is 104, the blending time of two miscible liquids is found to be 15s. The power required is 2 hp per 0.4 kW/m3 of liquid..

i. What power input would be required to give the same blending time in a vessel 1830 mm in diameter.

ii. What would be the blending time in the 1830 mm vessel if the power input per unit volume was the same as in the pilot-plant vessel?

8. (a) Explain the phenomena of crystallization from melts.

(b) Describe Brodic puri¯er counter current coolingcrystallizer.