Ref. No.: EX/PG/FTBE/T/113C/ 2018

M.TECH(F.T.B.E) 1 ST SEMESTER EXAMINATION- 2018

DAIRY ENGINEERING Time: 3hrs Full Marks: 100

Use Separate Answer Script for each Part

(50 marks for each part)

PART- I

Answer question 1 and any two from the rest.

1. Explain the following: 4 X 5
   a) Malted milk
   b) Continuous freezer for icecream freezing
   c) Emulsifier and stabilizer for icecream preparation
   d) Property and defects of milk powder.

2. a) What is meant by drum drying of milk? Explain the factors on which the efficiency of drum drying of milk depend.
   b) A drum drier is being designed for drying a product from an initial total solids content of 12% and a final moisture content of 4%. An average temperature difference between the roller surface and the product of 65^0C will be used. The overall heat transfer coefficient is1500 kcal/hm^2 ^{0}C. Determine the surface area of the roller required to provide a production rate of 50 kg product/h. 3+6+6

3. a) Discuss with mechanism about homogenization of milk. Explain the effect of homogenization on milk and dairy products.
   b) Explain about over run and shrinkage of ice cream 5+5+5

4.a)State the functions of Icecream freezer.

b)What are the factors influencing the freezing time?

c)Find out the refrigeration load of an icecream freezer in tonnes when capacity of the freezer 700kg/h, drawing temperature -5^{0}C, initial temperature of mix 4^{0}C , initial freezing temperature of mix -2.5^{0}C ,water content of mix 63%, sp. heat of mix 0.8, sp. heat of mix at 100% overrun 0.6, % of water frozen at -5^{0}C, 47%. Assume that 85% of the heat equivalent of the work done by the motor appears as heat in the icecream. The freezer requires 5kW motor to drive the dasher and radiation loss is 3% of the total heat. (1 kw = 860 kcal/h) 2.5+3.5+9

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M.TECH. FOOD TECHNOLOGY AND BIO-CHEMICAL ENGINEERING FIRST YEAR FIRST SEMESTER – 2018

Subject : DAIRY ENGINEERING **Time :3Hr** **Full Marks :100**

Part-II

Use Separate Answer scripts for each part / answer any two questions

1. Derive a heat balance equation used for design of spray dryer. Discuss how regeneration in plate heat exchanger occurs in milk industry using suitable diagram and operating parameter? What will be the expected evaporation temperature of droplet in spray dryer where air inlet temperature is 200^0C and milk inlet temperature is 60^0C and why?

   10+7.5+7.5=25

2. Derive an equation for relating flow rate and diameter of particles which will settle to the wall of tubular bowl centrifuge.

   In a vegetable oil refining process, an aqueous phase is being separated from the oil phase in a centrifuge. The density of the oil is 909.5 kg/m^3 and that of the aqueous phase is 980.3 kg/m^3. The radius for over flow of the light liquid has been set at 10.16 mm and the outlet for the heavy liquid at 10.414 mm. Calculates the location of the interface in the centrifuge.

   15+10=25

3. Calculate the drying time for a liquid atomized in a centrifugal atomizer at a feed rate of 20 ib/min (9.07 kg/min) at a peripheral speed of 250 ft/s. based on the drying time on a particle size representing a diameter larger than that of 90% of the total droplet produced. Assume that there is no change in droplet diameter with drying. The liquid originally has a density of 993 kg/m^3 and moisture content 8% (wet basis), using air at 175^0 C and a humidity of 0.001 H_2 O / dry air. The critical moisture content is 2 g H_2 O / g dry matter. The dried solids have a density of 0.3 g/cm^3. Exit air temperature is 104.4^0C and Product exit temperature is 54.4^0C.

   What do you mean by pass-discuss with example and sketch?

   20+5=25

Please turn over for necessary graph.....

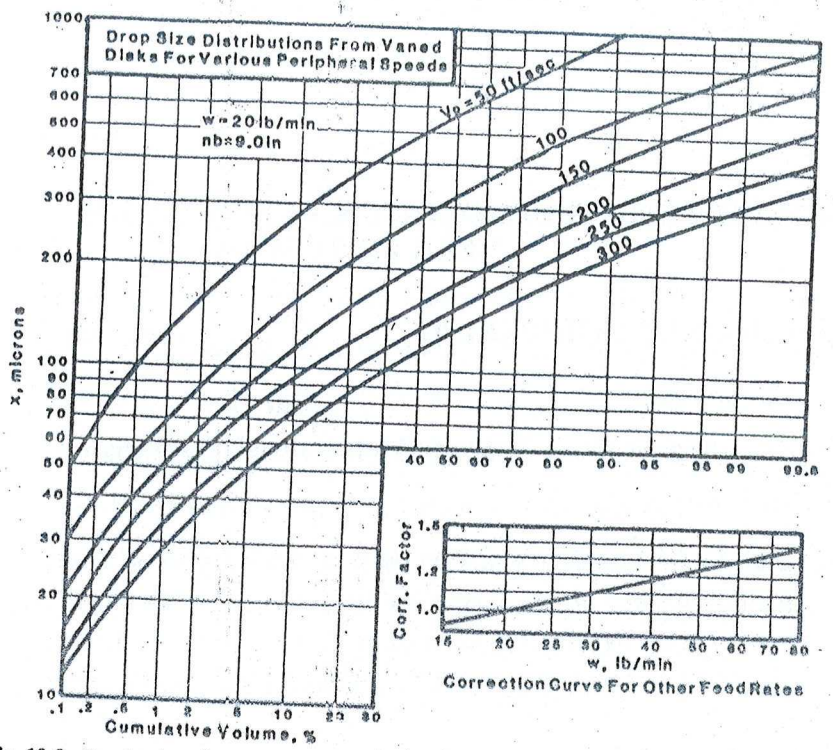

Fig. 12.8. Droplet size as a function of peripheral speed of a centrifugal atomizer. (From Marshall, W. R., Jr., 1954. *Chem. Eng. Prog. Monogr. Ser.* 50(2):71. AIChE, New York. Used with permission.)

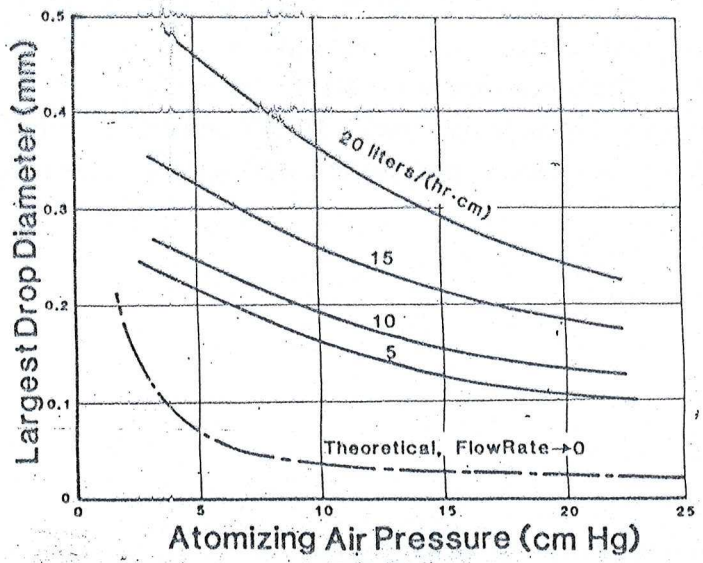

Fig. 12.9. Droplet size as a function of pressure in a pneumatic atomizer. (From Marshall, W. R., Jr., 1954. *Chem. Eng. Prog. Monogr. Ser.* 50(20):79. AIChE, New York. Used with permission.)