KERALA AGRICULTURAL UNIVERSITY

B.Tech (Food.Engg) 2010 Admission

IVth Semester Final Examination- July -2013

Cat. No: Fden.2207   Marks: 80

Title: Unit operations in Food Engineering (2+1)   Time: 3 hours

I. Fill up the blanks with most appropriate answers.   (0.5×10 = 5)

1. ------------------- Law is used to predict the solubility of a gas in a liquid.

2. The two types of radiations used for irradiating foods are --------------- & ----------------.

3. ------------------- occurs when pressure greater than the osmotic pressure is exerted on a solution in contact with a semi permeable membrane.

4. The common cryogens used in food processing are -------------------- & ---------------------.

5. The most commonly used membrane in membrane separation process is ---------------.

6. The depth of penetration of microwave into a food is directly related to---------------------.

7. Climbing type evaporators are used for ---------------------- foods.

8. ---------------------- is the separation of solids from liquid by passing the mixture through fine pores.

9. Energy required to grind a material from one size to another is expressed by -----------.

10. If the gauge pressure of gas inside the cylinder is 5 kg/cm², the absolute pressure of the gas will be -------------- kPa.

II. Define any **FIVE** of the following.   (1×5 = 5)

1. Sedimentation
2. Emulsification
3. Ultra filtration
4. Distillation
5. Extrusion
6. Crystallization

III. Write short notes on any FIVE of the following.   (4×5 = 20)

1. Vapour compression
2. Cryogenic grinding of spices
3. Reverse osmosis process and membranes used
4. Ribbon blender / mixer
5. Basket centrifuge
6. Expression for settling velocity

IV. Answer any *EIGHT* questions. (5×8 = 40)

1. What are the advantages of multiple effect evaporators? Explain with neat sketch the various types of multiple effect evaporators.

2. Derive an expression for constant pressure filtration. Explain a plate and frame filter press.

3. Define Kicks law. Explain a colloid mill and where it is used in food industry?

4. Differentiate between leaching and extraction. Explain super critical extraction.

5. Orange juice is to be concentrated from 15% solids to 60% in a single effect evaporator. The feed rate to the evaporator is 20,000 kg/h. The overall heat transfer coefficient is 28000 kcal/m^2-hr-°C. Neglecting boiling point elevation, calculate steam consumption, economy and the area of heat transfer surface if the temperature of feed is 50°C. Latent heat of steam is 530 kcal/kg. Condensing temperature is 125°C. At the heat exchanger pressure, latent heat of vaporization of liquid is 600 kcal/h and the boiling point is 60°C.

6. Explain a twin screw extruder with a neat sketch and state its utility.

7. A bowl centrifuge is used to break oil in water emulsion. Determine the radius of the neutral zone in order to position the feed pipe correctly. Assume the density of the continuous phase as 1000 kg/m^3 and the density of oil is 870 kg/m^3. The outlet radii from the centrifuge are 3 cm and 4.5 cm.

8. Explain the rate of crystal growth.

9. Explain the principle and operation of a microwave oven. What are the permitted microwave frequencies for the use in kitchen microwave ovens in India?

10. Define Homogenization? Explain briefly any two types of Homogeniser.

V. Answer any *one* question (10×1=10)

1. A continuous single effect evaporator concentrates 1.0% salt solution (specific heat 4.14 kJ/kg°C) to the final concentration of 1.5% (by weight). The salt solution at 9072 kg/h enters the evaporator at 311 K (37.8°C). The vapour space of evaporator is at 101.32 kPa absolute pressure while the saturated steam supplied is at 143.3 kPa. The overall coefficient is estimated to be, U = 1704 W/m^2-°C. Calculate the amounts of vapour and liquid products and the heat transfer area required. Assume that the solution has the same boiling point as water (since it is dilute).

2. After precipitation and draining procedures, it is found that 100 kg of fresh casein curd has a liquid content of 66% and this liquid contains 4.5% lactose. Calculate the residual lactose in the casein after drying if the curd is washed three times with 194 kg of fresh water each time. Also calculate the quantity of water that would have to be used in a single wash to attain the same lactose content in the curd as obtained after three washings. Assume perfect washing and draining of curd to 66% of moisture each time.

------------------&&&----------------