

# KERALA AGRICULTURAL UNIVERSITY

B.Tech (Food.Engg) 2012 Admission  
IV<sup>th</sup> Semester Final Examination- July -2014

Cat. No: Fden.2207

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

Marks: 80  
Time: 3 hours

**I. Fill up the blanks with most appropriate answers.**

(0.5×10 = 5)

1. In attrition mills, the size of the food grain is reduced by -----.
2. Extraction of soluble constituents from a solid by using a solvent is called as -----.
3. The two types of radiations used for irradiating foods are ----- & -----.
4. ----- occurs when pressure greater than the osmotic pressure is exerted on a solution in contact with a semi permeable membrane.
5. The depth of penetration of microwave into a food is directly related to -----.
6. Climbing type evaporators are used for ----- foods.
7. Colloid mill is used for -----.
8. The heart of the homogenizer is known as -----.
9. Sedimentation uses ----- force to separate particulate material from liquid stream.
10. Ultra filtration membranes have a pore size of ----- to-----m.

**II. Define any FIVE of the following.**

(1×5 = 5)

1. Food irradiation
2. Gas absorption
3. Vacuum distillation
4. Emulsification
5. Crushing efficiency
6. Filter cake resistance

**III. Write short notes on any FIVE of the following.**

(4×5 = 20)

1. Reverse osmosis process and membranes used
2. Open pan evaporator
3. Size reduction equipments (any two type)
4. Basket centrifuge
5. Derive an expression for settling velocity
6. Industrial mixing equipments for solid products

**IV. Answer any EIGHT questions.**

**(5×8 = 40)**

1. Short notes on Hot and Cold Extrusion of Food and the equipments used.
2. Define Homogenization? Explain briefly any two types of Homogenisers.
3. Explain with neat sketch the various types of multiple effect evaporators. What are the advantages of multiple effect evaporators?
4. What is meant by constant pressure filtration? Explain the construction and operation of plate & frame filter press.
5. Describe the construction of a jaw crusher with a neat sketch and state its utility.
6. Explain the principle of crystallization. Describe the construction and operation of any one of the crystallizers used in food processing.
7. What is meant by *Super Critical Extraction*? Explain this process with appropriate schematic sketch.
8. It is found that the energy required to reduce particles from a mean diameter of 1 cm to 0.3 cm is 11 kJ/kg. Estimate the energy requirement to reduce the same particles from a diameter of 0.1 cm to 0.01 cm assuming: a) Kick's law, b) Rittinger's law and c) Bond's law.
9. Discuss about steam and vacuum distillation processes.
10. Explain the construction and operation of cyclones. Give a couple examples of their applications in food processing industry.

**V. Answer any ONE question**

**(10×1=10)**

1. A single-effect evaporator is used to produce a tomato concentrate with 35% solids from a raw juice containing 6% solids. The pressure in the evaporator is 20 kPa absolute and steam is available at 100 kPa gauge. If the overall heat transfer coefficient is 440 W/m<sup>2</sup>-K, the boiling temperature of the juice under the evaporator conditions is 61°C and the area of heat transfer surface of the evaporator is 12 m<sup>2</sup>, estimate the feed rate of raw juice that is required to be supplied to the evaporator.
2. A feed of 100 kg/h sugar solution containing 25% solids is fed to an evaporator producing a concentrate of 60% solids which is then fed to a crystallizer. From the crystallizer, a material of 97% solids is removed while saturated sugar solution of 42% solids is recycled to the evaporator. Calculate the amount of recycled stream and product stream.

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