



Name :

Roll No. :

Invigilator's Signature :

CS / B.TECH(FT) / SEM-6 / FT-604 / 2012

2012

FOOD PROCESS AND EQUIPMENT DESIGN

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

Use steam Table

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :

10 × 1 = 10

i) Example of Oil-in-water type emulsion is

- | | |
|-----------|-------------|
| a) Butter | b) Milk |
| c) Fog | d) Aerosol. |

ii) Fat globules are broken during homogenization due to

- | | |
|------------------------|-------------------|
| a) Interfacial tension | b) Shear force |
| c) Both of these | d) None of these. |



- iii) Autoclave is used for
- a) Heating purposes b) Blanching purposes
 - c) Sterilization purposes d) none of these.
- iv) Sublimation is a phase change from
- a) Liquid to vapour
 - b) Solid to vapour
 - c) Vapour to solid
 - d) Vapour to liquid.
- v) Spray drying is suitable for drying of
- a) Liquid food material
 - b) Solid food material
 - c) Both of these
 - d) None of these.
- vi) Dimension of drying chamber in spray dryer depends on
- a) Air flow rate b) Mass flow rate of feed
 - c) Type of atomizer used d) None of these.

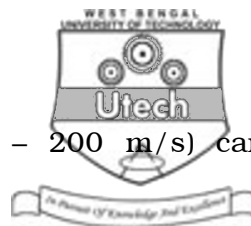
- Equilibrium moisture is removed
- Bound moisture is removed
- Free moisture is removed
- None of these.

- Spray drying
- Drum Drying
- Tray drying
- Rotary Drying.

a) peas b) shrimp

c) meat d) all of these.

a) 20 % b) 30 %
c) 40 % d) 50 %.



xi) The rotating atomizing wheel (100 – 200 m/s) can produce particle size in a range of

- a) 1– 500 μm
- b) 1–5000 μm
- c) 1–800 μm
- d) All of these.

xii) Vacuum Jacketed pan is to be designed the design pressure will be increased by

- a) 1 kg/ cm^2
- b) 2 kg/ cm^2
- c) 3 kg/ cm^2
- d) 4 kg/ cm^2 .

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Estimate the steam requirement as you start to heat 50 kg of pea soup in a jacketed pan, if the initial temperature of the soup is 18° C and the steam used is at 100 kPa gauge. The pan has a heating surface of 1 m² and the overall heat transfer coefficient is assumed to be 300 J m⁻² s⁻¹ °C⁻¹. Data given :

Saturation temperature of steam at 100 kPa gauge = 120°C and latent heat = 2202 kJ kg⁻¹.

3. Draw a net sketch of Fluid bed dryer and briefly state its principle.



4. What are different types of homogenizer ? States its application.
5. Write short notes on the following : $2\frac{1}{2} + 2\frac{1}{2}$
 - (a) Steam Jacketed pan
 - (b) Tray Dryer.
6. A food containing 80% water required to be dried to 10% moisture. The initial temperature of food = 21° C. Calculate the average of heat energy required/ unit weight of original material. Latent heat of vaporization of H₂O = 2257 kJ/kg. The specific heat capacity of food = 3.8 kJ/kg°C. The specific heat capacity of H₂O = 4.186 kJ/kg°C.
7. Write the design criteria of "stiffeners".
8. Briefly explain the working principle of a pulping machine.

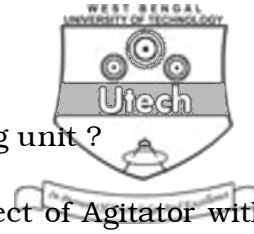
GROUP – C

(Long Answer Type Questions)

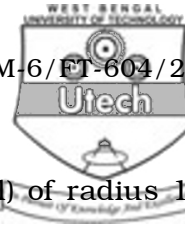
Answer any *three* of the following. $3 \times 15 = 45$

9.
 - a) Draw a neat sketch of Pasteurizer, labeling all parts.
 - b) What are the advantages of Basket press system ?
 - c) Sketch neatly and discuss about a Rotary Roster.

5 + 5 + 5



10. a) Why do we need Baffling in the Mixing unit ?
b) Briefly discuss about the design aspect of Agitator with a clean diagram.
c) What is solid Mixer ? 3 + 9 + 3
11. a) Briefly discuss about solid and liquid mixture in a continuous process.
b) Discuss the working principle of a plate freezer.
c) Write the operational equation of a constant pressure filtration. 5 + 7 + 3
12. a) Briefly explain about hydrostatic sterilizer.
b) Discuss the working principle of a rotary atomizer.
c) What are the advantages of a continuous concentrator system ?
d) What is the difference between freeing and freeze drying ? 5 + 5 + 3 + 2
13. a) An autoclave having a vertical axis is open at the top. Its inside diameter is 300 cm and the height is 25m. The autoclave is full of wet steam (water) and is made of structural steel having a yield stress of 22 kN/cm^2 . Determine the thickness of the steel sheet used if the efficiency of longitudinal joint is 70% and the factor of safety is 3.



- b) A spherical Homogenizer (Made by steel) of radius 1 m and 30 mm shell thickness is submerged in the water. Yield stress of steel is 700 Mpa and density of water is 10 kN/m^3 . Taking a factor of safety is 2.

Determine the depth of water of the submerge Homogenizer in the water . 7 + 8

14. a) Raw milk (Density = 1020 kg/m^3) is flowing through a homogenizer at 65°C . Maximum pressure developed during homogenization is 3000 Psi. What will be temperature of milk after homogenization if specific heat of milk is $3.85 \text{ kJ/(kg}^\circ\text{C)}$. Why raw milk is heated to 65°C prior to homogenization ? 3 + 2
- b) Calculate time at 62.8°C for pasteurization of milk. F_0 value to be used at 65.6°C is g minute and z value is 5°C ? 5
- c) Write the design loads for pressure vessel. 5
15. What are the advantages and disadvantages of single and twin screw extruder used in food industry ? Discuss the important design parameters of a twin screw extruder. 5 + 10

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