Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech/FT(N)/SEM-5/FT-503/2012-13

2012

FOOD PROCESS ENGINEERING

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.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : 10 × 1 = 10

i) Milk along with fat globules forms an

a) water-in-oil emulsion

b) oil-in-water type emulsion

c) water-in-air type emulsion

d) none of these.

ii) Fat globules in milk are surrounded by a membrane consisting of

a) protein and water

b) proteins and phospholipids

c) lipid and water

d) all of these.

iii) Fresh milk in heated to 65˚C or higher before homogenization

a) to reduce interfacial tension between the fat globule and the liquid phase surrounding the globules

b) to coagulate some fraction of milk protein

c) in order to in-activate lipase enzyme

d) all of these.

iv) Freezer burn is caused due to

a) Air coming in contact with the surface of the food

b) Sublimation

c) Fluctuation in temperature within a freezer

d) All of these.

v) Case hardening is caused by

a) too much temperature

b) too much air velocity

c) too little humidity

d) all of these.

vi) Steam should be brough into the retort

a) from the top b) from the bottom

c) in the middle d) in any position.

vii) Extruder most commonly used in food industry is

a) Co-rotating twin screw type

b) Counter rotating twin screw type

c) Non-intermessing twin screw type

d) any one of these.

viii) Most food will not begin to freeze until

a) 5˚C b) – 2˚C

c) 0˚C d) – 18˚C.

ix) For an organism *D* value at 160˚F is 0.45 minutes. If the *Z*-value is 10, what will be the *D* value at a temperature of 140˚F ?

a) 450 minutes b) 45 minutes

c) 4.5 minutes d) none of these.

x) Cold store uses unit cooler designed with good circulation of air because

a) Cheapest to install without heavy structure and readily defrosted

b) Contains a relatively small charge of refrigerant

c) Both (a) and (b).

d) Only (a).

xi) A wood slab 10 cm thick has one face at – 12°C and the other face at 21°C. If the mean thermal conductivity of wood in this temperature range is 0.28 $Jm^{-1} s^{-1} 0C^{-1}$, what is the rate of heat transfer through l m^2 of wall ?

a) 92.4 Js^{-1} b) 85.5 Js^{-1}

c) 97.4 Js^{-1} d) 90.2 Js^{-1}.

xii) LMTD means

a) Low Mass Thermal Death

b) Log Mean Thermal Difference

c) Log Mean Temperature Difference

d) Low Melting Temperature Data.

xiii) During drying of foods

a) Equilibrium moisture is removed

b) Bound moisture is removed

c) Free moisture is removed

d) Combination of (a) and (b).

xiv) Example of orange juice concentrator is

a) Batch type pan evaporator

b) Rising film evaporator

c) Falling film evaporator

d) Agitated thin film evaporator.

xv) Cryogens utilized in cryogenic freezing will be

a) Lequid nitrogen gas

b) Liquid hydrogen gas

c) Liquid carbon dioxide gas

d) both (a) and (b).

GROUP – B
(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Draw a schematic diagram of a falling film evaporator and state its working principle. What is the basic difference between it and rising film evaporator. 4 + 1

3. Discuss the mechanism of homogenizing action.

4. Explain cryogenic chilling machine in batch and continuous system.

5. With a neat diagram, explain the various parts of a can seaming machine.

6. Discuss the factors to be considered for calculating the refrigerant load of a cold storage.

7. How is freeze drying occurred ? Explain the working principle of drum dryer. 2 + 3

GROUP – C
(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

8. a) Give the labelled sketch of a double seamer and explain its operation procedure.

   b) Explain the operating precedures of stationary retorts oriented vertically and horizontally. 8 + 7

9. a) Mention the factors affecting rate of drying. Explain the three different periods which occur during process with a time *vs* drying rate/temperature sketch. 3 + 4

   b) Calculate the requirement of heat to dry 60 kg product per hour, drying it from 55% moisture to 10% moisture. Given the latent heat of evaporation at drying temperature = 2257 kJ/kg. 3

   c) A 2 cm thick veal slab is dried using a freez drying process. Initially the product has a moisture content of 75% and it is desired to dry it until it reaches 5% moisture content. The initial density of veal is 1050 kg/m^3. If the sublimation is kept at 260 μm Hg, and a pressure of 100 μmHg, is maintained in the condenser, calculate the drying time. Suppose that permeability of freeze dried product = 0.75×10^{-9} kg/m.s.μmHg. 5

10. a) Describe Plate freezer and cold Air Blast freezer (batch type, cabinet freezer).

    b) How transportation of frozen foods occur ?

    c) Differentiate between conventional drying and freeze drying process. 6 + 5 + 4

11. Briefly describe different types of cold storage. Cite the applications of different types of insulating materials used in cold storage construction. Describe the methodology of insulation. Discuss the utility of refrigerated container in fish transporation system. 5 + 3 + 3 + 4

12. a) A drum drier is being designed for drying of a product from an initial total solid content of 12% to a moisture content of 4%. An overall heat transfer coefficient (U) of 1700 Wm^{2} °C is being estimated for the product. An average temperature difference between the roller surface and the product of 85°C will be used for design purpose. Determine the surface area of the roller required to provide a production rate of 20kg/hr.L = 2420 J/kg.

    b) What are the advantages & disadvantages of fluidized bed dryer ? 10 + 5

13. Name two extruded food products. Compare single screw extruder with twin screw extruder. Briefly explain the working principle of single screw or twin screw extruder.

2 + 3 + 10

14. Write short notes on any *three* of the following : 3 × 5

a) Tray drier

b) Oil expeller

c) Kneader

d) Fouling in heat exchanger

e) Solar drier

f) Refrigerated vans.