*Name* : ...................................................................

*Roll No.* : ...............................................................

*Invigilator's Signature* : ...............................................

**CS/B.TECH(FT)/SEM-5/FT-503/2010-11**

# 2010-11

# 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 the following :

                          $10 \times 1 = 10$

   i)    Solar dryer is a type of

       a)    Conduction drying     b)    Convectional drying

       c)    Both of these           d)    None of these.

   ii)    In Extruder barrel temperature is

       a)    primary variable       b)    secondary variable

       c)    machine constant      d)    none of these.

   iii)    In plate type heat exchangers

       a)    only counter current flow is used

       b)    only concurrent flow is used

       c)    either type of flow may be used

       d)    none of these.

iv) Shrimps may be dried most efficiently in

    a)   Tray dryer          b)   Freeze dryer

    c)   Fluidized bed dryer    d)   none of these.

v) Heat damage may occur in

    a)   Drum drying        b)   Spray drying

    c)   both of these        d)   none of these.

vi) When the inlet hot air temperatures are same, high rate of evaporation are achieved at the 'Wet end' in the case of

    a)   Counter current system

    b)   Concurrent system

    c)   Both of these

    d)   None of these.

vii) Which is the controlling factor for a drum drier ?

    a)   Diffusion          b)   Heat transfer

    c)   Both (a) and (b)    d)   Neither (a) nor (b).

viii) Moisture contained by a substance in excess of the equilibrium moisture is called

    a)   Unbound moisture   b)   Free moisture

    c)   Critical moisture    d)   Bound moisture.

ix) In the comparison of single screw extruder & twin screw extruder, single screw extruder

    a) design is less complex & operation is easier

    b) design is less complex, but operation is not easier

    c) design is more complex & operation is not easier

    d) design is more complex, but operation is easier.

x) For a given material, the moisture content expressed as wet weight basis

    a) have greater value

    b) have lesser value

    c) have value - compared to the moisture content expressed as dry weight basis

    d) none of these.

### 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.     5

3. Write the mechanism of homogenization action and draw a neat sketch of ultrasonic homogenizer.     5

4. Draw a neat sketch of single screw extruder and explain its operating principle and procedure.     5

5. Write the operating procedure of a Plate type heat exchanger.     5

6. Prove that the batch drying time $t = W/AR_c ( X_1 – X_2 )$ , where

$X_1$ = initial moisture content     A = area of drying

$X_2$ = final moisture content     $R_c$ = constant rate of drying

W = mass of dry solid.     5

5218         3         [ Turn over

## GROUP – C

### ( Long Answer Type Questions )

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

7. a) Give the flow diagram of spray drying process and indicate the various flow patterns of both air and feed droplets in its drying chamber.    7

    b) A drier is fed with wet solid to reduce the moisture content from 80% to 15%. The product leaving the dryer is admitted to an oven which further brings down the moisture to 2%. If the drier can handle 1000 kg of wet solid per day, calculate.

      i) The weight of products leaving the drier and the over per day.

      ii) The percentage of the original water that is removed in the drier and the oven.    8

8. a) Draw the labelled diagram of a commercial tray type freeze drier and explain its principle of operation and advantages.    12

    b) Differentiate between conventional drying and freeze drying processes.    3

9. Discuss the different types of cold stores used in storage of fresh and frozen foods.    15

10. With a neat diagram, discuss the various parts of a can seaming machine. Discuss the double seaming process.

                                           10 + 5

11. a) A cold storage wall ( 3 × 6 m ) is constructed of 15 cm thick concrete ( thermal conductivity = 1·37 W/m°C ). Insulation must be provided to maintain a heat transfer rate through the wall at or below 500 W. If the thermal conductivity of the insulator is 0.04 W/m°C, compute the required thickness of the insulation. The outside surface temperature of the wall is 38°C and the inside wall temperature is 5°C.    10

    b) What is cold chain ?    5