Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH/FT(O)/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
(True / False Type Questions)

1. Answer the following by indicating whether the statements are *True* (*T*) or *False* (*F*) : 10 × 1 = 10

   i) Heat damage is maximum in thin film evaporator.

   True / False

   ii) An abrasive material made from silicon and carbon is known as carborundum.

   True / False

   iii) Tin cans are made of thin steel plate of high carbon content and lightly coated on either side with tin metal to thickness of about 0.0025 cm.

   True / False

   iv) Steam should be brought into the retort from the bottom.

   True / False

v) Shear stress is primary extrusion variable and screw speed is secondary extrusion variable. *True / False*

vi) The length, thickness, cover hook, body hook of a A-2 $\frac{1}{2}$ can is 2·97 to 3·17, 1·4 – 1·45, 1·9, 2·16 respectively. *True / False*

vii) Liquid physically or chemically bound to a solid food matrix which at the same temperature is known as free moisture. *True / False*

viii) The clearance between rollers of double drum drier is of the range of (0·1 – 0·12) inch which is considered optimum. *True / False*

ix) Normally the height of cold storage is 1·5 m and 23 – 30% space is provided for movements. *True / False*

x) The velocity of the air needed to achieve fluidization of spherical particles is equal to $\sqrt{\frac{4d(\rho_s - \rho)}{3 c_d \rho}}$, where d is the diameter of the particle in metre, ρ_s is density of solid particles to be dried in kg/m ^{3}, ρ is the density of air in kg/m ^{3} and c_d is drag coefficient. *True / False*

GROUP – B

(Short Answer Type Questions)

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

2. Differentiate between the following :

i) Cold storage and frozen storage

ii) Refrigeration and freezing

iii) Conventional drying and freeze drying.

3. Compare between the following :
   i) Ultrafiltration with reverse osmosis
   ii) Falling film evaporator with Climbing film evaporator
   iii) Vat pasteurization with plate pasteurization.
4. In what way does the drying differ from evaporation ? Discuss the mechanism of drying.
5. Explain the function of the following parts in a double seaming machine :
   i) Base plate
   ii) Seaming chuck
   iii) First operation seaming roll
   iv) Second operation seaming roll.
6. Explain about the function and construction material of extrusion screw, barrel, die and cutter of a macaroni extruder.

GROUP – C

(Long Answer Type Questions)

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

7. a) Discuss the operation of a double drum drier indicating its feeding arrangement.

   b) A food containing 80% water is to be dried at 100 degree centigrade down to moisture content of 10%. If the initial temperature of the food is 21 degree centigrade, calculate the quantity of heat energy required per kilogram weight of the original material for drying under atmospheric pressure.

   Given :

   Latent heat of vaporization of water at 100 degree centigrade and standard atmospheric pressure = 2257 kJ/kg.

   Specific heat capacity of food = 3.8 kJ/kg/degree centigrade. 10 + 5

8. a) Draw a neat sketch of a single screw extruder and explain its operating principle and procedure.

   b) Discuss about the type of twin screw extruder and its application and advantages. 8 + 7

9. a) Describe a vertical steam retort along with the general specifications of its various fittings and the cycle of its operation.

   b) The diameter and length of a drum drier is 0·7 m and 0·85 m respectively. The feed enters at a preheated temperature of 100 degree centigrade and gets dried at 150 degree centigrade. The initial moisture content of the feed is 80% and it is to be dried to a moisture content of 20%.

   Given the feed density = 1020 kg/m^3

   The overall heat transfer coefficient = 1200 $W/m^2/K$.

   The doctors blade removes the feed after every $\frac{3}{4}$ revolution of drum.

   The feed layer thickness on the drum surface = 0·6 mm.

   The latent heat of vaporization of product = $2{\cdot}258 \times 10^6$ joule/kg.

   Calculate the speed of the drum. 10 + 5

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

    a) 2-stage homogenizer

    b) Solar drier

    c) Cryogenic freezer

    d) Components of shell and tube heat exchanger

    e) High speed dough mixer.