Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech(FT/OLD)/SEM-6/FT-604/2013

2013

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.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

i) Throttling Calorimeter is used for the measurement of

a) heat transfer coefficient

b) dryness fraction of steam

c) saturation temperature of steam at a particular pressure

d) none of these.

ii) Steam has

a) saturation temperature independent of pressure

b) saturation temperature above the critical point

c) only one saturation temperature at each pressure

d) none of these.

iii) The dimension of kinematic viscosity is

a) $ML^{-1}T^{-2}$ b) $ML^{-1}T^{-1}$

c) L^2T^{-1} d) none of these.

iv) The angle of a Saddle support

a) should not normally be greater than 120°

b) must be equal to 120°

c) should not normally be less than 120°

d) none of these.

v) The relation between absolute pressure, atmospheric pressure and vacuum pressure is

a) Absolute pressure = (Atmospheric pressure) – (vacuum pressure)

b) Absolute pressure = (Atmospheric pressure) + (vacuum pressure)

c) Atmospheric pressure = (Absolute pressure) – (vacuum pressure)

d) None of these.

vi) A vessel of $0{\cdot}4 m^3$ capacity containing 2 kg wet steam have a specific volume (usual unit)

a) 5 b) 0·2

c) 0·8 d) none of these.

vii) General equation for flat plate is

a) $t = CD_e(f / P)^{0{\cdot}5}$ b) $t = PD_i/(2f - P)$

c) $t = CD_e(P / f)^{0{\cdot}5}$ d) none of these.

viii) The dimensional unit of "pascel" is

a) $kg\ m^{-1}sec^{-2}$ b) $kg\ m^{-1}sec^{-1}$

c) $kg\ m^{-2}sec^{-1}$ d) $kg\ m^{-2}sec^{-2}$.

ix) Psychrometry is a

a) Physical relationship between steam and gas

b) Study of the behaviour of mixtures of air and water

c) Chromatographic analysis

d) none of these.

x) For food products (such as fruit juice) that are very heat sensitive and where low differentials are allowable in the heat exchanger, then they can be concentrated using

a) long tube evaporator

b) high pressure evaporator

c) falling film evaporator

d) none of these.

xi) Thermocouple is a

a) heat transfer coefficient measuring device

b) temperature measuring device

c) thermal conductivity measuring device

d) none of these.

xii) In Engineering the transition from elastic behaviour to plastic behaviour is called

a) Plasticity b) Rigidity

c) Yield d) None of these.

GROUP – B

(Short Answer Type Questions)

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

2. How can you calculate wall thickness and permissible internal pressure considering the weld joint efficiency factor and the allowable stress value.

3. What is the purpose of using "stiffening ring" in cylindrical and spherical process equipment under external pressure or vacuum ? What will be the effective length in such case ?

4. Why co-current type of spray drier is suitable for improved product quality compared to counter current type ?

5. Why grided plates are used in a plate type freezer ?

6. What type of food materials are dried in a drum drier ? Mention the factor on which the drying rate depends.

GROUP – C

(Long Answer Type Questions)

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

7. It is necessary to design a drum drier for the production of mango flakes. What are the important design parameters for this type of drier using steam as heating medium ?

8. How would you proceed to design a co-current type of spray drier for drying of fluid milk ? How can you calculate the average drop size and chamber dimension of the drying unit ?

9. It is necessary to design a tray drier for drying of fish. What factors should you consider for determination of dimension of the drying chamber and trays ? What factors you should consider for the design of the drying unit for its satisfactory operation ?

10. Calculate the temperature of tomato juice (density 980 kg/m^3) in a steam jacketed hemispherical kettle after 5 min. of heating. The radius of the kettle is 0·5 m. The convective heat transfer coefficient in the steam jacket is 5000 W/m^2°C. The inside surface temperature of the kettle is 90°C. The initial tempter of tomato juice is 20°C. Assume specific heat of tomato juice is 3·95 KJ/kg°C.

11. How can you evaluate the design parameters of a rotary drier used for drying of paddy ? What is the function of various flights used in commercial rotary driers ?

12. What are the major uses of a plate freezer ? What materials are used for the construction of the plates ? How can you determine the freezing time in a plate freezer ?