



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.*

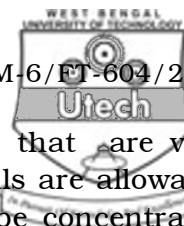
**GROUP – A**

**( 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  $120^\circ$
  - b) must be equal to  $120^\circ$
  - c) should not normally be less than  $120^\circ$
  - 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  $0.4\text{m}^3$  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)  $t = CD_e (f / P)^{0.5}$
  - b)  $t = PD_i / (2f - P)$
  - c)  $t = CD_e (P / f)^{0.5}$
  - d) none of these.
- viii) The dimensional unit of "pascal" is
  - a)  $\text{kg m}^{-1}\text{sec}^{-2}$
  - b)  $\text{kg m}^{-1}\text{sec}^{-1}$
  - c)  $\text{kg m}^{-2}\text{sec}^{-1}$
  - d)  $\text{kg m}^{-2}\text{sec}^{-2}$ .
- 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
- long tube evaporator
  - high pressure evaporator
  - falling film evaporator
  - none of these.
- xi) Thermocouple is a
- heat transfer coefficient measuring device
  - temperature measuring device
  - thermal conductivity measuring device
  - none of these.
- xii) In Engineering the transition from elastic behaviour to plastic behaviour is called
- Plasticity
  - Rigidity
  - Yield
  - None of these.

### GROUP – B

#### ( Short Answer Type Questions )

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

- How can you calculate wall thickness and permissible internal pressure considering the weld joint efficiency factor and the allowable stress value.
- 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 ?
- Why co-current type of spray drier is suitable for improved product quality compared to counter current type ?
- Why grided plates are used in a plate type freezer ?
- 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.  $3 \times 15 = 45$

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  $980 \text{ kg/m}^3$ ) 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  $5000 \text{ W/m}^2\text{°C}$ . The inside surface temperature of the kettle is  $90^\circ\text{C}$ . The initial temperature of tomato juice is  $20^\circ\text{C}$ . Assume specific heat of tomato juice is  $3.95 \text{ KJ/kg}^\circ\text{C}$ .
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 ?

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