

Name :

Roll No. :

Invigilator's Signature :

CS/B.PHARM/SEM-4/PT-407/2012

2012

PHARMACEUTICAL 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) Size reduction for micronized aspirin and griseofulvin is done by
 - a) fluid energy mill
 - b) colloid mill
 - c) ball mill
 - d) all of these.
- ii) Constant boiling solutions are completely separated by
 - a) Fractional distillation
 - b) Azeotropic distillation
 - c) Distillation under reduced pressure
 - d) Simple distillation.

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- iii) Corrosion of steel in a pharmaceutical industry can be prevented by
- a) Chromates b) Sulphates
- c) Bi-carbonates d) Carbonates.
- iv) For a spherical particle the value of volume shape factor is
- a) 3.14 b) 6.00
- c) 2.59 d) none of these.
- v) The effect of baffles in a heat exchanger is to
- a) hold the tubes in position
- b) increase turbulence
- c) clean the outer tube surface
- d) all of these.
- vi) Efficiency of momentum transfer in a solid-solid mixing depends on
- a) elasticity of collision
- b) coefficient of friction
- c) surface area of contact
- d) all of these.
- vii) Hammer mill is an example of
- a) Grinder b) Crusher
- c) Ultra-fine grinder d) Cutter mill.



- viii) The Tyler standard screen series is based on
- a) 240 mesh screen
 - b) 200 mesh screen
 - c) 150 mesh screen
 - d) all types of mesh screen.
- ix) Which of the following surfaces has the maximum emissivity ?
- a) Smooth and black
 - b) Smooth and white
 - c) Rough and white
 - d) Rough and black.
- x) Formation of foam of a boiling liquid in an evaporator is removed by
- a) Castor oil
 - b) Lemon oil
 - c) Peanut oil
 - d) Shark liver oil.
- xi) An evaporator fed with 5000 lb/hr of 1% (w/w) solution will have solute flow rate of the product equal to
- a) 50 lb/hr
 - b) 500 lb/hr
 - c) 50.50 lb/hr
 - d) 20.25 lb/hr.
- xii) Heat sensitive material like orange juice is concentrated in a
- a) long tube evaporator
 - b) basket evaporator
 - c) falling-film evaporator
 - d) all of these.



GROUP - B

(Short Answer Type Questions)

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

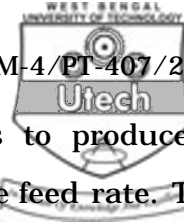
2. What is caking of crystals ? List the factors affecting and preventive measures for caking. $2 + 3$
3. What should be the diameter of a set of rolls to take feed of size equivalent to 38 mm spheres and crush to 12.7 mm ?
4. Explain the statement “use of evaporator with moderate steam pressure under vacuum is economical”.
5. Describe the statistical analysis to evaluate the mixer’s performance.
6. What is vortex formation and what are its disadvantages in liquid mixing ? Suggest methods to eliminate vortex formation.

GROUP - C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. Classify and enumerate the different types of corrosion. Explain that the relative velocity of corrosive solution with respect to a metal surface is a significant factor in corrosion. A simple vacuum crystallizer is to produce 20000 lb FeSO₄ crystals/hr. The feed is a solution containing 40 parts FeSO₄ /100 part of total water and enter the crystallizer at



160°F. The crystallizer vacuum is such as to produce a crystallizer temperature of 80°F. Calculate the feed rate. The given data are : The saturated solution of FeSO_4 at 80°F contains 30.5 parts of FeSO_4 / 100 parts of total water. Molecular weight of FeSO_4 and $\text{FeSO}_4 \cdot 5\text{H}_2\text{O}$ are 151.9 and 278 respectively.

$$h_L = -2.4 \text{ BTU/lb}, \quad h_C = -9.10 \text{ BTU/lb},$$

$$h_F = -46.8 \text{ BTU/lb}, \quad H = 1096 \text{ BTU/lb.} \quad 5 + 3 + 7$$

8. a) Explain in brief the power consumption of impellers.
- b) A tank 1.2 m in diameter and 2 m high is filled to a depth of 1.2 m with a latex having a viscosity of 10 poise and a density of 800 kg/m^3 . The tank is not baffled. A three blade 360 mm diameter propeller is installed in the tank at 360 mm from the bottom. The motor available develops 8 kW.
- i) Is the motor adequate to drive this agitator at a speed of 800 rpm ?
- ii) If the above is baffled, is the motor adequate to drive this agitator at a speed of 800 rpm ?

Data : When $NR_e = 1382.4$ then for unbaffle tank $N_p = 0$ and for baffled tank $N_p = 0.86$. 5 + 10



9. a) Derive the overall heat transfer coefficient through temperature gradient in forced convection.

b) A furnace is constructed with 2 m of fire brick, 0.1 m of insulating and 0.2 m of building brick. The inside temperature is 1200 K and the outside temperature is 330 K. If the thermal conductivity are as $K = 1.4 \text{ W/mK}$, 0.21 W/mK , 0.7 W/mK respectively, estimate the heat loss per unit area and the temperature at the junction of the firebrick and the insulating brick. What are the applications of heat exchangers in the process plant ? Write their functions. 5 + 7 + 3

10. a) A co-current multipass heater is used to cool 200 kg/sec of water from 360 K to 340 K by means of 250 kg/sec of cold water entering 300 K. If L.M.T.D. correction factor is 0.7, determine ;

i) True L.M.T.D.

ii) necessary overall heat transfer area in m^2 .

(U-value of heater is $2 \text{ kW}/(\text{m}^2)(\text{K})$).

b) If the above operation would have been conducted by countercurrent fashion,

i) determine Overall heat transfer area.

ii) Compare the efficiency of the two operations with proper explanation with respect to manufacturing cost factor of the heater. 7 + 6 + 2



11. a) With a neat diagram describe the working principle and use of any *two* of the following : 2 × 5

- i) Fluid energy mill
- ii) Colloid mill
- iii) Cyclone separator.

b) With a neat diagram describe the construction, working principle of climbing film type evaporator. 5

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