[48] No. of printed pages : 2

SARDAR PATEL UNIVERSITY
M. Sc. (II Semester) Examination
Monday, 3rd December 2012
10.30 a.m. to 1.30 p.m.
PS02ESCT01 : Chemical Engineering Operations

Total Marks : 70

Instructions:

- Understand the questions properly and answer in proportion to the marks it carries.
- Precise and to the point answers will be appreciated.
- Assume relevant data if necessary or hence otherwise stated.
- Figures to the right indicate maximum marks.

Q-1 Select the correct answer from the following. **[08]**

1. Grinders operate principally by
   (a) Slow compression (b) Impact (c) Attrition (d) Cutting
2. Baffles are provided in heat exchanger to increase
   (a) Heat transfer coefficient (b) Heat transfer area (c) Fouling factor (d) Heat transfer rate
3. To separate a binary mixture, the relative volatility should be
   (a) Equal to one (b) Less than one (c) Greater than zero (d) Greater than one
4. In case of ball mill
   (a) Coarse feed requires a larger ball (b) Fine feed requires a larger ball (c) Operating speed should be more than critical speed (d) Maximum grinding takes place at critical speed of mill
5. Detergent powder is produced by
   (a) Freeze dryer (b) Spray dryer (c) Rotary dryer (d) Tray dryer
6. If a body reflect all radiations incident on it then it is known as a
   (a) Black body (b) White body (c) Grey body (d) Transparent body
7. Which filter is used for washing, partial drying & discharging all takes place simultaneously?
   (a) Plate & frame (b) Leaf (c) Rotary vacuum (d) Vacuum
8. Heat is transferred by from an insulated pipe to the surrounding still air by
   (a) Conduction (b) Convection (c) Radiation (d) All of the above

Q-2 Answer **any seven** of the following. **[14]**

1. Define Unit operations and Unit processes. List out the various types of unit operations with examples.
2. Distinguish between open circuit and close circuit operations.
3. Explain the industrial application of various size reduction equipments.
4. Briefly explain the various modes of heat transfer.
5. Discuss the heat flow and its estimation through composite wall
6. List out the various types of filter media and filter aids.
7. Discuss about the Propeller and turbine impeller.

8. Briefly explain about baffled tank and types of mixing problems.
9. Briefly explain the construction and working of centrifugal pump.

Q-3 (a) Explain with neat diagram the working principle and industrial application of Ball Mill. [06]

(b) Explain with neat diagram the working principle and industrial application of Jaw Crusher. [06]

OR

(b) A Blake Jaw crusher is used for crushing limestone such that the average size of the particles is reduced from 63 mm to 15 mm with energy consumption of 52 W-hr/Metric ton. Calculate the energy consumption for the same material from average size of 85 mm to 20 mm. Use Kick's law and Bond's law. For limestone the work index is 12.75. [06]

Q-4 (a) Define distillation & relative volatility. Explain schematically the working of a simple distillation showing all the important details. [06]

(b) Explain about minimum reflux ratio and its calculation. [06]

OR

(b) With a neat sketch explain the working principle and industrial application of Rotary dryer. [06]

Q-5 (a) Write a short note on "Rotameter". (*A note preferably should include working principle, brief about construction, applications and related issues)* [06]

(b) Calculate heat transfer area required for counter flow heat exchanger to cool 15.7 kg/s of alcohol from 339 K to 313 K using 11.4 kg/s of water available at 380 K. Assume heat transfer coefficient 500 W/m^2 K. Specific heat of alcohol and water are 3.76 and 4.184 kJ/kg K respectively. [06]

OR

(b) Explain with a neat sketch the construction and working of a shell & tube heat exchanger. [06]

Q-6 (a) 3000 kg/h of calcite passes through a crusher and grinder in succession (connected on the same power drive). Screen analysis from the crusher shows a surface area of product of 108 m^2/kg. Screen analysis of grinder product indicates a surface area of 900 m^2/kg. Estimate the power required for the drive to run the above machines if the efficiencies of the crusher & grinder are 28% and 35% respectively. Rittinger's No. of calcite is 82 cm^2/kg.cm. Make suitable assumption if necessary. [06]

(b) Write a short note on "Cyclone Separator". (*A note preferably should include working principle, brief about construction, applications and related issues)* [06]

OR

(b) Discuss about the general construction, working principle and industrial application of "Plate and Frame filter press". [06]

The Paper Ends