Scheme – G

Sample Question Paper

Course Name : Diploma in Chemical Engineering
Course Code : CH
Semester : Third **17313**
Subject Title : Mechanical Operations
Marks : 100 **Time: 3 hrs**

Instructions:

1. All questions are compulsory
2. Illustrate your answers with neat sketches wherever necessary
3. Figures to the right indicate full marks
4. Assume suitable data if necessary
5. Preferably, write the answers in sequential order

Que. 1 A) Attempt any SIX of the following. **12 Marks**

a. What are the objectives of size reduction?

b. The power required for crushing is calculated by following equation:

$$\frac{P}{\dot{m}} = 0.3162 W_i \left[\frac{1}{\sqrt{D_{sb}}} - \frac{1}{\sqrt{D_{sa}}}\right]$$

Write the meaning and unit of each variable.

c. Name the IS code for selecting test sieve. Write any four screen sizes in this series.

d. Define screening. State it's two application.

e. List the methods by which vortex formation could be avoided.

f. Define classification. Name any two types of classifier used in process industry.

g. What is tramp iron? Why its separation is necessary?

h. State importance of mixing in process industries (any four points)

Que. 1B) Attempt any ONE of the following. **06 Marks**

a. What are different actions commonly employed for the selection of size reduction equipments. Explain with suitable example of each.

b. Define critical speed of ball mill. Write its formula. State the criteria for selecting the operating speed of ball mill.

c. Mention the factors affecting the performance of screen.

Que. 2 Answer any FOUR of the following. **16 Marks**

a. What is sphericity? Write the formula to calculate it. State its significance.

b. Distinguish between grizzlies and vibrating screen on the basis of following points:

i. Motion imparted to screening surface.

ii. No. of screening surface in one assembly.

iii. MOC of screening surface and arrangement

iv. Application.

c. Draw the neat sketch of trommel with multiple screening surfaces in same assembly. State its application.

d. List the laws of crushing. Explain any one non mechanical type of classifier.

e. The dispersion of fine solid particles in air was causing nuisance in packaging section of an industry. An engineer suggested using cyclone separator to resolve the problem. Is he right? State how cyclone separator separates solids dispersed in air. Draw proportionate sketch of cyclone separator.

f. Explain cake filtration and deep bed filtration. Draw representative sketch.

Que. 3 Answer any FOUR of the following. **16 Marks**

a. Draw the neat sketch of fluid energy mill. State its working principle.

b. A quartz mixture is screened through a 10 mesh screen

c. With neat sketch, explain the working of electrostatic separator. State its application.

d. What is the significance of cake resistance? How it is denoted? State one method of reducing cake resistance.

e. Explain working of rotary vacuum drum filter.

f. Draw the neat sketch of washing type of plate and filter press.

Que: 4 Answer any FOUR of the following. **16 Marks**

a. Explain construction of gyratory screen.

b. What is the difference between magnetic concentrators and purifiers? Write one example of each.

c. Water after clariflocculator is to be filtered. The capacity requirement is high but small space is available for installation the filter. Suggest suitable filter. Draw the neat sketch.

d. Explain the classification of filter on the basis of:

i. Driving force

ii. Mode of filtration

Give one example of each.

e. Define terminal settling velocity. Draw the sketch of continuous thickener showing different zones.

f. Distinguish between sedimentation and centrifugation on the basis of:
   i. Principle
   ii. Application
   iii. Space required
   iv. Equipments used.

Que. 5 Solve any ONE of the following. **16 Marks**

a. Derive an expression relating size of crushing roll, size of feed, product size and angle of nip.
A double roll crusher having set of crushing rolls of 100 cm diameter and 35 cm width face are to be set so that the crushing surfaces are 1.4 cm apart at narrowest point. Find out the maximum permissible feed size to the crusher if angle of nip 32^0.

b. What is froth floatation? Explain with neat sketch construction and working of flotation cell.

c. Explain the laboratory batch sedimentation. State its significance.

Que. 6 Answer any TWO of the following. **16 Marks**

a. Describe the procedure to calculate filter medium and cake resistance during the batch filtration process.

b. What is flow pattern? Draw the neat sketch of flow pattern generated by axial and radial flow impeller.

c. State the significance of mixing index. Write the formula to calculate mixing index.

d. Explain the construction and working of ribbon blender.

e. Suggest the mixer to be used for dispersion of rubber in liquid. Explain its construction.

f. A flat blade turbine type impeller is installed in a vertical 1.8 m diameter vessel which is filled with 48% NaOH solution to a depth of 1.8 m. The turbine is 60 cm in diameter and positioned 60 cm from the bottom of the tank. The turbine is operated at 90 rpm. The tank is fitted with four baffles each having width 18 cm. Calculate power required if power number is 6.

Data: Density of 48% NaOH = 15 kg/m^3

Viscosity of the solution = 10 cP