(ii) Describe the working of centrifugal pump and obtain an expression for the work done by pump.

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 0650 Roll No. | | | | | | | | | | |

B. Tech.

(Semester-III) Theory Examination, 2011-12

FLUID FLOW & SOLID HANDLING

Time : 2 Hours] *[Total Marks : 50*

Note : (i) Attempt *all* questions.

(ii) Be precise in your answer.

(iii) Assume suitable data if required.

1. Attempt *all* parts of this question : 1×10=10

(a) Write the name of any two unit operations commonly used in chemical industry.

(b) What do you mean by Grinding ?

(c) What is sedimentation ?

(d) What is sphericity ?

(e) The work required for crushing of solids is proportional to the new surface created. This is known as _____ law.

(f) Give the physical significance of Reynold's number.

(g) When nothing such as ideal fluid exists, what is the utility of studying flow of ideal fluids ?

(h) What do you mean by vacuum pressure ?

(i) The critical speed of the ball mill depends on the radii of _____ and _____.

(j) What is fluidization ?

2. Attempt any *three* parts of this question : 5×3=15

(a) Discuss the principle and working of Belt conveyor with the help of neat sketch.

(b) A sand mixture was screened through a standard 10-mesh screen. The mass fraction of the oversize material in feed, overflow and underflow were found to be 0.38, 0.79 and 0.22 respectively. Calculate the overall screen effectiveness.

(c) Derive Bernoulli's equation applies momentum balance approach. Also discuss the limitations of Bernoulli's equation.

(d) A simple U-Tube manometer is installed across an orifice meter. The manometer is filled with mercury (specific gravity = 13.6) and the liquid above the mercury is water (specific gravity =1). The manometer reads 200 mm. What is the pressure difference over the manometer in N/m^2 ?

(e) Describe the working of Rotameter and obtain the expression for flow rate of a fluid.

3. Attempt *all* parts of this question : 5×5=25

(a) Attempt any *one* of the following :

(i) Classify the various types of flow meters and with the help of neat sketch discuss the working principle of a venturimeter for flow measurement.

(ii) A Pitot tube is placed in the centre of a pipe of 50 cm diameter. The difference between the static and impact pressure in 5.5 cm of water. The coefficient of discharge of Pitot tube is 0.98. Determine the average velocity and volumetric flow rate of water.

(b) Attempt any *one* of the following :

(i) A certain set of crushing rolls has rolls of 100 cm diameter by 38 cm width face. They are so set that the crushing surfaces are 1.25 cm apart at the narrowest point. The manufacturer recommends that they may be at 5 to 100 rpm. They are to crush a rock having a specific gravity of 2.35 and the angle of nip is 30°. What are the maximum permissible size of feed and the maximum actual capacity in tons per hour, if the actual capacity is 12 percent of the theoretical ?

(ii) A material is crushed in Jaw crusher and the average size of particle is reduced from 5 cm to 1.3 cm, with consumption of energy at the rate of 37 watts.hr/metric ton. What will be the consumption of energy necessary to crush the same material of average size 8 cm to an average size of 3 cm by using :

(1) Rittenger's law

(2) Kick's law.

(c) Attempt any *one* of the following :

(i) Water flowing at 1.5 L/s in a 0.05 m diameter tube is metered by means of a simple orifice of diameter 0.025 m. If the coefficient of discharge is 0.62, what will be the reading on mercury under water manometer connected to the meter ? Density of water = 1000 kg/m^3, viscosity of water = 0.001 Ns/m^2, density of mercury=13600 kg/m^3.

(ii) Water is flowing through a pipe of diameter 30 cm and length 60 m connected to the base of a tank. The water level in the tank is 5 cm above the centre line of pipe. The friction factor f=0.006. Density of water 1000 kg/m^3 and viscosity of water is 1m N-S/m^2. Determine the volumetric flow rate of water.

(d) Attempt any *one* of the following :

(i) A rotary vacuum filter is used to filter an aqueous slurry of $CaCO_3$ containing 236 kg of solids per m^3 water (density of water = 1000 kg/m^3). If the filter cake contains 50 percent moisture (wet basis). Calculate the quantity of solids deposited in the filter per unit volume of filtrate in kg/m^3.

(ii) The volumetric flow rate during constant pressure filtration is :

$$\frac{dV}{dt} = \frac{1}{K_c V + \frac{1}{Q_o}},$$

where V is the total volume of filtrate collected in time t, and K_c and Q_o are constants.

(1) Make a sketch of t/V versus V from your results.

(2) Given V = 1 litre at t=41.3s and V=2 litres at t=108.3 s, find K_c.

(e) Attempt any *one* of the following :

(i) Describe the working of reciprocating pump and obtain an expression for the work done by pump.