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SARDAR PATEL UNIVERSITY
EXTERNAL EXAMINATION, OCTOBER 2016
M.Sc INDUSTRIAL CHEMISTRY-SEMESTER 3
PS03CICH 08: Process Safety Management and transportation of fluids

Date: 25th Oct, 2016

Total marks: 70

Time: 2.00 p.m.-5.00 p.m

Answer all the questions.

Figures to the right indicate marks.

Q1. Write the number of the correct statement (8 * 1 = 8 marks)

a. At high Reynolds number,-----

- i. Viscous forces predominate iii. Inertial forces predominate
ii. Gravity forces predominate iv. Both viscous and gravity forces predominate

b. The ratio of inertial force to viscous force is called

- i. Viscosity ii. Surface tension iii. Newtons number iv. Reynolds number

c. The friction factor for turbulent flow in a hydraulically smooth pipe -----

- i. Depends only on Reynolds number iii. Does not depend on Reynolds number
ii. Depends on roughness iv. None of these

d. For terminating a pipeline,----- is used.

- i. coupling ii. elbow iii. plug iv. valve

e. The head (H) of a centrifugal pump depends on the rpm of the impeller (N) according to the relation

- i. $H \propto N^2$ ii. $H \propto N$ iii. $H \propto N^3$ iv. $H \propto N^5$

f. For getting uniform discharge in a reciprocating pump,----- is used

- i. foot valve ii. air vessel iii. needle valve iv. gate valve

g. NPSH of a centrifugal pump must be -----

- i. >1 ii. <1 iii. 1 iv. 0.7

h. LD₅₀ of potassium cyanide is -----

- i. less than 15 iii. More than 25 and less than 50
ii. more than 50 iv. None of these

Q2. Answer any Seven (7 * 2 = 14 marks)

- a. Define Power number and NRe power
b. Define fanning friction factor
c. Write the principle of fluidization
d. Write Hagen-poiseuille equation and enlist any 2 applications
e. Define the various regions of flow when solid particles settle through fluids

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- f. Distinguish between free and hindered settling
- g. Define TLV and IDHL
- h. Distinguish between LFL and UFL
- i. Define material factor in Dow F & EI Index

Q3.

- a. A reciprocating pump has a piston of dia 0.12 m and stroke of length 0.3 m. The pump center is 4 m above the sump level and 30 m below the delivery level. The diameter of suction pipe is 0.068 m and that of delivery pipe is 0.05 m. If the pump works at 60 rpm and has a mechanical efficiency of 80 %, find the horse power required to drive the pump. (06)
- b. A centrifugal pump delivers 0.03 m³/s of water to a height of 18 m through a pipe 90 m long and 0.1 m diameter. If the efficiency of the pump is 75 % and if the friction factor is 0.012, find the horse power required to drive the pump. (06)

OR

- b. A single acting reciprocating pump having a piston of dia 0.15 m and stroke of length 0.3 m discharges 0.2 m³/s of water at 40 rpm. Calculate the co-efficient of discharge and % slip of the pump. (06)

Q4.

- a. Prove that the velocity profile over a pipe section is parabolic in shape. (06)
- b. With the help of neat sketches, distinguish between propeller, turbine and paddles. (06)

OR

- b. Derive the equation for terminal settling velocity of a spherical particle moving through a fluid under the action of centrifugal force in the Newton's flow range. (06)

Q5.

- a. Particles of density 7500 kg/m³ and dia 0.00025 m are to be settled from their mixture with water of density 1000 kg/m³ and viscosity 0.001 kg/m sec. If a settling time of 60 sec is available, what should be the height of the settling chamber? Use g = 9.81 m/sec² (06)
- b. Distinguish between dilution ventilation and local exhaust ventilation (06)

OR

- b. Describe in detail, HAZOP (06)

Q6.

- a. Write a note on hot work permit and mechanical integrity as applied to process safety management (06)
- b. With an example, explain fault tree analysis (06)

OR

- b. Write the various steps involved in the calculation of DOW F & EI Index (06)

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