* K C - 8 0 4 5 *

KC-8045

B. E. - II (Sem. III) (Chemical) Examination

November / December – 2012

Fluid Flow Operation

(New Course)

Time : Hours] [Total Marks : **100**

Instructions :

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :

☛ B. E. - 2 (SEM. 3) (CHEMICAL)

Name of the Subject :

☛ Fluid Flow Operation (New)

☛ Subject Code No. : 8 0 4 5 ☛ Section No. (1, 2,.....) : 1&2

Seat No. :

Student's Signature

(3) Figures to the right indicate full marks.
(4) Assume suitable data if necessary.
(5) Draw neat sketches wherever necessary

SECTION - I

1 (a) Answer the following : **2×5=10**

(1) Distinguish between compressible and incompressible fluid.

(2) Calculate hydraulic radius and equivalent diameter for a duct of square cross section of side "b".

(3) Draw a curve for boundary layer formation on a flat plate.

(4) What is transition length and fully developed flow ?

(5) Define isentropic expansion and Adiabatic frictional flow for a fluid flowing through a conduit.

(b) Derive the Bernoulli's equation for the potential flow through inclined stream tube without friction. 8

2 Answer any two : **8×2=16**

(a) Explain : Manometer and Derive the expression for differential pressure in U-tube manometer.

(b) Air at 20°C and 2 atm absolute pressure enters a finned tube steam heater through a 50 mm tube at an average velocity of 15 m/s. It leaves the heater through a 65 mm tube at 90°C and 1.6 atm absolute. What is the average and mass velocity of fluid ?

(c) Derive the relationship between the skin friction loss and pressure drop in a straight pipe.

3 Attempt any two : **8×2=16**

(a) Water at the rate of 200 tones per hour has to be pumped from a river to a factory overhead tank placed at a height of 25 meters from the river bed, the total length of the pipe line being 1.5 kms. cast iron pipe having an inside diametre of 30 cm will be used for the purpose. The average temperature of water in the river may be taken as 30°C, for which condition viscosity is 0.764 C.P. Calculate :

(a) The Reynolds number

(b) The head lost due to friction

Friction factor is given by $f = 0.0014 + \frac{0.125}{\mathrm{Re}^{0.32}}$

(b) A pump draws a solution of sp gr: 1.84 from a storage tank of large c/s through a pipe having an I.D. of 0.08 m. The average fluid velocity in the section line is 3 m/sec. The pump discharge through a pipe of I.D. 0.065 m. The end of the discharge line is 35 meters above the level of the solution in the feed tank. Friction losses in the entire system are 4.7 meters of the solution. What pressure must the pump develop in kg/cm^2 ? Assuming overall efficiency of 60%, calculate the energy requirement in kwh ?

(c) For a continuous gravity decanter derive the following equation :

$$Z_{A_1} = \frac{Z_{A_2} - Z_T\left(r_B / r_{A_1}\right)}{1 - r_B / r_A}$$

Discuss how the position of liquid, liquid interface affects the separation.

SECTION - II

4 (a) Answer the following : **2×5=10**

(1) Distinguish between free settling and hindered settling.

(2) Define : Drag and Drag coefficient.

(3) Give difference between pipe and tube.

(4) What is NPSH for centrifugal pump ?

(5) The gas compressors are designed with small clearance between the moving parts. Why ?

(b) Discuss principle, construction and working of single and double acting reciprocating pump in detail. 8

5 Attempt the following : (any **two**) **8×2=16**

(a) An orifice meter equipped with flange taps is to be installed measure the flow rate of topped crude to a cracking unit. The oil is flowing through 100 mm pipe and adequate run of straight pipe is available for the installation of meter. The expected maximum flow rate is 79.5 m^3/hr. mercury is to be used as a manometric fluid, and glycerol is to be used in the leads as sealing liquid. The maximum reading of the meter is 762 mm. Calculate :

(i) The diameter of the orifice

(ii) The power loss of 68% of the orifice differential is permanently lost.

Data :

SP gravity of oil = 0.89 sp. gr. of Glycerol = 1.11

SP gravity of Hg = 13.6 ρ (density) of water = 1000 kg/m^3

co-efficient of meter = 0.61

(b) In case of flow of fluid through long, straight and circular pipe, the pressure drop/loss due to friction depends upon the following variables :

(i) Diameter of Pipe (D)

(ii) Length of Pipe (L)

(iii) Velocity of fluid (u)

(iv) Density of fluid (ρ)

(v) Viscosity of fluid (μ)

From dimensional analysis, obtain the relation between pressure drop (DP) and these variables.

(c) Discuss the construction and working of Rotameter.

6 Attempt the following : (any **two**) **8×2=16**

(a) What is fluidization ? Explain conditions for fluidization with plot of pressure drop and bedwight Vs. Superficial velocity for a bed of solids.

(b) A Pitot static tube having a co-efficient of 0.98 is placed at the centre of pipeline in which benzene is flowing. A manometer attached to the Pitot tube contains mercury and benzene and shows a reading of 10 cm. Calculate the velocity at the centre line of the pipe specific gravity of benzene is 0.88.

(c) Write in brief about gate valves and globe valves.