* U F - 8 0 4 5 *

UF-8045

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

May / June – 2012

Fluid Flow Operation

(New Syllabus)

Time : **3** 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

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

SECTION - I

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

(i) Convert 1 atm in lbf/inch^2.

(ii) Define viscosity and momentum flux.

(iii) Draw the diagram for the development of boundary layer flow in pipe.

(iv) Define skin friction and form friction appearing in boundary layers.

(v) Define stream lines and stream tubes.

(b) Explain in detail : The Newtonian and Non-Newtonian fluids with their examples and behaviour. 8

2 Attempt any two : **8×2=16**

(a) Explain hydrostatic equilibrium and derive barometric equation based on it.

(b) Crude oil is to be transported from an oil field to a refinery located 750 km away from the source through a steel pipe line 40 cm I.D. The difference in level between the two is negligible. Calculate :

(i) Horse Power theoretically required to overcome friction in the line.

(ii) Since maximum allowable pressure in any section of the line is 30 kg/cm^2 it will be necessary to insert additional pumping stations at suitable intervals along the line. Each station increases the pressure which drops to 1.7 kg/cm^2 at the inlet to the next pumping station. What is the smallest number of pumping station required ?

(c) A manometer of the type of used to measure pressure drop across an orifice. Liquid A is mercury (ρ_{Hg} =13.590 kg/m^3) and fluid B is brine (ρ_{brine} =1260 kg/m^3), pressure at taps are equal. The level of mercury is manometer is 0.9 m below the orifice taps. The pressure gauge at that time is 0.14 bar and pressure at the downstream tap is 250 mm Hg below atmospheric.
What is reading of manometer in milimeters ?

3 Attempt any two : **8×2=16**

(a) Discuss the friction loss from sudden expansion of cross section and sudden contraction of cross section.

(b) A pipe 10 cm in diameter and 10 m long carries oil whose specific gravity is 0.85 and viscosity 0.11 kg/m.s. If the oil flows at a rate of 3 Kg/S, find the pressure loss in the pipe and also the shear stress at pipe wall.

(c) Water at 20°C is pumped from a storage tank through 100 meters of 3.0 cm diameter pipe. The pipeline has two globe valves which are fully open and three 90° elbows. Water is discharged into another tank through a spray nozzle. The discharge is at a height of 20 meters above the level of water in the storage tank. The pressure required at the nozzle entrance is 3 kg/cm^2 gauge. Estimate

(i) The energy loss-due to friction

(ii) Pump work required per kg of water.

Data : Viscosity of water at 26°C = 0.975 C_P
1.5 metric h.p. = 75 kg.m/sec.
Equivalent length in terms of pipe diameter
Open globe valve = 300 D, 90° elbow = 30 D.

SECTION - II

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

(i) Define form drag and wall drag.

(ii) Write down the force balance equation when a particle attains in terminal settling velocity.

(iii) What is venacontracta in orifice meter ?

(iv) Is positive displacement pumps are self priming ? Justify your answer.

(v) Define : Check valve. State types of check valve.

(b) Write a brief note on Fans, Blowers and compressors used in chemical industry. 8

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

(a) Shown by the method of dimensions that the resistance R to the motion of G sphere of diameter ϕ moving with uniform velocity $\bar{V}$ through a fluid having density ρ and viscosity μ may be expressed as

$$R = \rho d^2 \bar{V}^2 \phi \left(\mu / \rho \bar{V} d \right)$$

(b) An orificemeter consisting of 10 cm diameter orifice, in a 25 cm diameter pipe has co-efficient of 0.65. The pipe delivers oil of 0.8 specific gravity. The pressure difference on the two sides of the orifice plate is measured by a mercury oil differential manometer. If the differential gauge reads 80 cm of mercury, calculate the rate of flow in litre/sec.

(c) Write principle, construction and working of pitot tube with neat sketch. Discuss advantages, disadvantages and application of pitot tube.

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

(a) Write a brief note on types of fluidization and its application in chemical industry.

(b) A venturimeter is to be installed in a sehedule 40.4 in (100 mm) line to measure the flow of water. The maximum flow rate is expected to be 73.8 m^3/hr. The 1.27 m manometer used to measure the differential pressure is to be filled with mercury and water is to fill the leads about the mercury surfaces. What throat diameter should be specified for venturi and what will be the power required to operate the meter at full load ? Assume coefficient of meter is 0.98.

(c) What are different losses occur in centrifugal pump ? Discuss characteristic curves of centrifugal pump with plot.