B.TECH. SEM -IV (CHEMICAL) 2014 COURSE (CBCS) :
SUMMER - 2018
SUBJECT: FLUID FLOW OPERATIONS

Day: **Tuesday** Time: **10.00 AM TO 01.00 PM**
Date: **05/06/2018** **S-2018-2271** Max Marks: 60

N.B:

1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.
3) Assume suitable data if necessary.
4) Use of non- programmable **CALCULATOR** is allowed.

Q.1 **a)** State and derive equation for hydrostatic equilibrium with neat labeled diagram. **(06)**

b) Kinematic and dynamic viscosities of a liquid are 1.6 stokes and 1.392 poise, respectively at a given temperature and pressure. Calculate specific mass and specific volume of the liquid at that temperature and pressure. **(04)**

OR

Q.1 **a)** Explain U- tube differential manometer and inverted U- tube differential monometer with neat labeled diagram. **(06)**

b) A simple U- tube manometer is used to measure the pressure of oil (specific gravity = 0.8) flowing in a pipe line. Its right limb is open to the atmosphere and left limb is connected to the pipe. The center of the pipe is 9 cm below the level of mercury (specific gravity = 13.6) in the right limb. If the difference of mercury level in the two limbs is 15 cm, determine the absolute pressure of the oil in the pipe in N/cm^2. **(04)**

Q.2 **a)** State and derive Bernoulli's equation. **(06)**

b) A 30 cm diameter pipe conveying water, branches into two pipes of diameters 20 cm and 15 cm, respectively. If the average velocity in the 30 cm pipe is 2.5 m/s. Find the discharge in this pipe. Also determine the average velocity in 15 cm pipe, if the average velocity in 20 cm diameter pipe is 2 m/s. **(04)**

OR

Q.2 **a)** Derive an expression for the velocity distribution in fully developed laminar flow in circular pipe using formula $\tau = -\left(\frac{\partial p}{\partial x}\right)\frac{r}{2}$. Also sketch the velocity distribution and shear stress distribution across a section of pipe. **(06)**

b) An oil of viscosity 0.1 $N.s/m^2$ and relative density 0.9 is flowing a circular pipe of diameter 50 mm and of length 300 m. The rate of flow of fluid through the pipe is 3.5 L/s. Find the pressure drop in a length of 300 m and also the shear stress at the pipe wall. **(04)**

Q.3 **a)** Derive equation for pressure drop in venture-meter with neat labeled diagram. **(06)**

b) An orifice meter with orifice diameter 15 cm is inserted in a pipe of 30 cm diameter. The pressure gauges fitted upstream and downstream of orifice meter gives readings of 20.67 N/cm^2 and 9.20 N/cm^2, respectively. Coefficient of discharge for the orifice meter is given as 0.6. Find the discharge of water through pipe. **(04)**

OR

Q.3 **a)** Explain in detail the velocity distribution for turbulent flow in smooth pipe and rough pipes. **(06)**

b) A pitot static tube placed in the center of a 300 mm pipe line has one orifice pointing upstream and other perpendicular to it. The mean velocity in the pipe is 0.80 of the central velocity. Find the discharge through the pipe, if the pressure difference between the two orifices is 60 mm of water. Take coefficient of pitot tube as 0.98. **(04)**

Q.4 Derive Borda- Carnot equation for loss of head due to sudden expansion of pipe for fluid flowing through a pipe. **(10)**

OR

Q.4 **a)** Explain various types of major and minor losses takes place in pipe when fluid flowing through a pipe. **(06)**

b) A horizontal pipe of diameter 500 mm is suddenly contracted to a diameter of 250 mm. The pressure intensities in the large and smaller pipe is given as 13. 734 N/cm^2 and 11.772 N/cm^2, respectively. Find the loss of head due to contraction. Take coefficient of contraction as 0.62. **(04)**

Q.5 A pump draws a solution of specific gravity 1.8 from a storage tank through 8 cm diameter steel pipe. The velocity in suction pipe is 0.9 m/sec. The pump discharges through a 6 cm diameter steel pipe to an overhead tank. The end of discharge line is 12 m above the level of solution in the feed tank. Friction losses in entire system are 5.5 m of solution and pump efficiency is 65%. Calculate the power rating of the pump in HP. **(10)**

OR

Q.5 **a)** Explain in detail characteristics curves of centrifugal pump. **(06)**

b) Write a short note on blowers. **(04)**

Q.6 **a)** Explain particulate fluidization and bubbling fluidization. **(06)**

b) Write applications of fluidization. **(04)**

OR

Q.6 Write a note on **ANY TWO** of the following: **(10)**

a) Terminal setting velocity
b) Laminar and turbulent flow in boundary layer
c) Drag coefficient

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