BACHELOR OF TECHNOLOGY (C.B.C.S.) (2020 COURSE)
B.Tech.Sem - III CHEMICAL : : SUMMER - 2022
SUBJECT : FLUID MECHANICS

Day : Wednesday
Date : 01-06-2022

S-24434-2022

Time : 02:30 PM-05:30 PM
Max. Marks : 60

N.B.

1) All questions are **COMPULSORY**.
2) Figures to the **RIGHT** indicate **FULL** marks.
3) Assume suitable data **WHEREVER** necessary.
4) Draw neat and labelled diagram **WHEREVER** necessary.
5) Use of non-Programmable **CALCULATOR** is allowed.

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

b) The 70 ml sample in Redwood viscometer experiment (Redwood viscometer formula: kinematic viscosity (v) = $0.0026t - \frac{1.175}{t}$ in stokes) has weight 0.45 N. The time required for collecting given volume was recorded as 55.2 seconds. Calculate specific weight and dynamic viscosity at that temperature. **(04)**

OR

Q.1 **a)** What is difference between simple manometer and differential manometer? Derive an equation for inclined tube manometer with neat labeled diagram. **(06)**

b) The left limb of a U-tube mercury manometer is connected to a pipe line conveying water. The level of mercury in the left limb is 0.6 m below the centre of pipeline and the right limb is open to the atmosphere. The level of mercury in the right limb is 0.45 m above that in the left limb and the space above mercury in the right limb contains benzene (Specific gravity 0.88) to a height of 0.3 m. Find pressure in the pipe. **(04)**

Q.2 **a)** State and derive continuity equation for one dimensional fluid flow. Also write S.I. unit and dimensions for mass flow rate. **(06)**

b) A pipe line carrying oil of specific gravity 0.8, changes in diameter from 300 mm at position A to 500 mm diameter to position B which is 5 m at higher level. The pressures at A and B are 19.62 N/cm^2 and 14.91 N/cm^2 respectively and the discharge is 150 litre/sec. Determine the loss of head and direction of flow. **(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 the section of pipe. **(06)**

b) An oil of viscosity 0.7 Ns/m^2 and specific gravity 1.3 is flowing through a circular pipe of diameter 100 mm. The maximum shear stress at the pipe wall is given as 196.2 N/m^2. Find the pressure gradient and average velocity of flow. **(04)**

Q.3 **a)** Derive equation for venturimeter with neat labeled diagram. Also write the various cases to calculate value of difference of pressure head (h). **(06)**

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

OR

PTO

Q.3 **a)** Describe pitot tube with neat labelled diagram. **(06)**

b) Describe in detail the velocity distribution for turbulent flow in tubes for region near tube wall. **(04)**

Q.4 Derive Darcy-Weisbach equation for loss of head due to friction for fluid flowing through a pipe. **(10)**

OR

Q.4 **a)** Describe loss of head due to pipe bends, fittings and valves in pipe. **(06)**

b) A horizontal pipe of diameter 400 mm is suddenly contracted to a diameter of 200 mm. The pressure intensities in large and smaller pipe is given as 14.715 N/cm^2 and 12.753 N/cm^2 respectively. If coefficient of contraction is 0.62, find the loss of head due to contraction. **(04)**

Q.5 Water is to be pumped from large pond to a point 70 m above the level in pond at a rate of 10 m^3/hr. The discharge point and pond surface are open to the atmosphere. If the frictional losses in entire system are 0.35 kgf-m/kg and efficiency of pump is 65%, calculate the horse power (hp) required. Take diameter of pipe as 30 mm. **(10)**

OR

Q.5 **a)** Describe in detail priming and cavitation of centrifugal pump. **(06)**

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

Q.6 **a)** Describe in detail boundary layer separation and wake formation. **(06)**

b) Describe in detail laminar and turbulent flow in boundary layer. **(04)**

OR

Q.6 **a)** Describe the concept of fluidization with a graph of pressure drop and bed height v/s superficial velocity for a bed of solids. **(06)**

b) Describe in detail types of fluidization. **(04)**

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