

B.Tech. SEM -IV (Chemical) 2014 Course (CBCS) : WINTER - 2018
SUBJECT: FLUID FLOW OPERATIONS

W-2018-2327

Day: Wednesday
Date: 14/11/2018

Time: 02.30 PM TO 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 if necessary.
- 4) Use of non programmable **CALCULATOR** is allowed.

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- Q.1** a) Derive an expression for inclined tube manometer with neat labeled diagram. (06)
- b) A simple U-tube manometer containing mercury is connected to a pipe in which a fluid of specific gravity 0.8 and having vacuum pressure is flowing. The other end of the manometer is open to atmosphere. Find the vacuum pressure in pipe, if the difference of mercury level in the two limbs is 40 cm and the height of fluid in the left limb from the centre of pipe is 15cm below. (04)

OR

- Q.1** a) State and prove Pascal's law by considering a wedge shaped element of fluid. (06)
- b) A drum having 650 mm diameter and 1.3 m height is completely filled with an oil. Total weight is 3.25 KN and empty drum weight is 215 N. Calculate specific weight and specific mass of an oil. (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 0.87, changes in diameter from 200 mm at position A to 500 mm diameter at position B which is 4 m at higher level. If pressures at A and B are 9.81 N/cm² and 5.886 N/cm² respectively and the discharge is 200 litres/sec, determine the loss of head and direction of flow. (04)

OR

- Q.2** a) Derive Hagen Poiseulle equation for head loss in laminar flow through a circular pipe using formula $\bar{u} = \frac{1}{8\mu} \left(-\frac{\partial p}{\partial x} \right) R^2$. (06)
- b) A crude oil of viscosity 0.97 poise and specific gravity 0.9 is flowing through a horizontal circular pipe of diameter 100 mm and of length 10 m. Calculate the difference of pressure at the two ends of the pipe, if 100 kg of oil is collected in a tank in 30 seconds. (04)

P.T.O.

- 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 10 cm is inserted in a pipe of 20 cm diameter. The pressure gauges fitted in upstream and downstream of the orificemeter gives readings of 19.62 N/cm^2 and 9.81 N/cm^2 respectively. Coefficient of discharge for the orificemeter is given as 0.6 . Find the discharge of water through pipe. (04)

OR

- Q.3** a) Explain in detail Prandtl mixing length theory for turbulent flow. (06)
- b) Explain in detail the velocity distribution for turbulent flow in tubes for region near tube wall. (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 loss of head due to pipe bends, fittings and valves in pipe. (06)
- b) The rate of flow of water through a horizontal pipe is $0.25 \text{ m}^3/\text{sec}$. The diameter of pipe which is 200 mm is suddenly enlarged to 400 mm. The pressure intensity in the smaller pipe is 11.772 N/cm^2 . Determine loss of head due to sudden enlargement and pressure intensity in the large pipe. (04)
- Q.5** Water is to be pumped from a large reservoir from ground floor at a rate of $5 \text{ m}^3/\text{hr}$ to the open top of an absorption tower through 50 mm inner diameter (ID) pipe. The point of discharge is 6 m above the floor and frictional losses in the entire system is 0.25 kgf-m/kg. At what height in the reservoir the water be kept if the pump can develop 0.1 horsepower (hp). (10)

OR

- Q.5** a) Explain in detail Priming and Cavitation of centrifugal pump. (06)
- b) Write a short note on compressors. (04)
- Q.6** a) Explain types of fluidization. (06)
- b) Write applications of fluidization. (04)

OR

- Q.6** Write a note on (ANY TWO): (10)
- a) Minimum fluidization velocity
- b) Drag coefficient (C_D)
- c) Terminal setting velocity

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