

BACHELOR OF TECHNOLOGY (C.B.C.S.) (2021-COURSE)
B. Tech. Sem - III CHEMICAL : WINTER- 2022
SUBJECT : FLUID MECHANICS

Day : Tuesday

Time : 10:00 AM-01:00 PM

Date : 13-12-2022

W-25291-2022

Max. Marks : 60

N.B.:

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

- Q.1 a)** State and prove Pascal's law by considering a wedge shaped element of fluid. [06]
- b)** An oil of specific gravity 0.7 having 1 litre volume is mixed with 5 litre of other oil of specific gravity 0.82. Assume that the two oils are miscible. Calculate the density and specific weight of mixture. [04]

OR

- Q.1 a)** Describe U-tube differential manometer and inverted U-tube differential manometer with neat labeled diagram. [06]
- b)** The right limb of a simple U-tube manometer containing mercury is open to the atmosphere while the left limb is connected to a pipe in which a fluid of specific gravity 0.9 is flowing. The centre of pipe is 15 cm below the level of mercury in the right limb. Find the pressure of fluid in the pipe, if the difference of mercury level in the two limbs is 24 cm. [04]
- Q.2 a)** State and derive Bernoulli's equation along a stream line. Also write its assumptions and limitations. [06]
- b)** The water is flowing through a tapered pipe of length 100 m having diameters 600 mm at the upper end and 300 mm at the lower end, at the rate of 50 litre/sec. The pipe has a slope of 1 in 30. Find the pressure at the lower end, if the pressure at the higher level is 19.62 N/cm². [04]

OR

- Q.2 a)** Derive an expression for the shear stress distribution in fully developed laminar flow in circular pipe. Also sketch the shear stress distribution and velocity distribution across the section of pipe. [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) State and derive Continuity equation for one dimensional fluid flow. Also write S.I. unit and dimensions for mass flow rate. [06]
- b) A horizontal venturimeter with inlet diameter 30 cm and throat diameter 15 cm is used to measure the flow of oil of specific gravity 0.8. The discharge of oil through venturimeter is 50 litre/sec. Take coefficient of venturimeter as 0.98. Find the reading of the oil-mercury differential manometer. [04]

OR

- Q.3 a) Describe pitot tube with neat labeled diagram. [06]
- b) Describe in detail Prandtl mixing length theory for turbulent flow. [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) Describe various types of major and minor losses takes place in pipe when fluid flowing through a pipe. [06]
- b) A short horizontal pipe carrying water is enlarged from 10 cm to 20 cm diameter. If discharge through pipe is 1360 kg/min. Determine: [04]
- Loss of head at entrance
 - Loss of head due to sudden enlargement
 - Loss of head due to sudden contraction from 20 cm to 10 cm.
- 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 entire system is 0.25 kgf-m/kg . At what height in the reservoir the water be kept, if pump can develop 0.1 horse power (hp). [10]

OR

- Q.5 a) Describe in detail Cavitation and NPSH of centrifugal pump. [06]
- b) Write a short note on compressors. [04]
- Q.6 a) Describe in detail boundary layer separation and wake formation. [06]
- b) Describe in detail boundary layer formation in straight tube. [04]

OR

- Q.6 a) Explain the concept of fluidization with a graph of pressure drop and bed height v/s superficial velocity for a bed of solids. [06]
- b) Write applications of fluidization. [04]

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