	Utech
Name:	
Roll No.:	In Statement Will consisting and Conferent
Invigilator's Signature :	

2012

FLUID MECHANICS

Time Allotted: 3 Hours Full Marks: 70

The figures in the margin indicate full marks. Candidates are required to give their answers in their own words as far as practicable.

GROUP - A (Multiple Choice Type Questions)

Choose the correct alternatives for any *ten* of the following : 1.

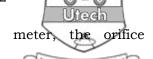
 $10 \times 1 = 10$

- At a given mass flow rate doubling the pipe diameter i)
 - a) reduce $N_{\rm Re}$ by $\frac{1}{2}$ b) doubles $N_{\rm Re}$
 - c) reduces $N_{\rm Re}$ by $\frac{1}{4}$ d) none of these.
- Stokes law is valid, when the particle Reynolds No. is ii)
 - a) < 1

b) > 1

c) < 5 d) none of these.

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- For a properly designed orifice meter, iii) coefficient can be
 - a) 0.60

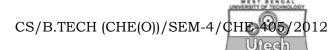
b) 1.05

0.8 c)

- 0.98. d)
- If the ratio of the diameter of the two sphere is 1.5, the iv) ratio of strokes drug on the two sphere should be
 - a) 1.5

4.5

- d) none of these.
- A $\frac{1}{3}$ decrease in the pipe dia will result in change in average velocity by
 - a) $\frac{4}{5}$ time decrease b) $\frac{3}{2}$ time increase
 - c) $\frac{5}{4}$ time increase d) none of these.
- Which of the following valves permit flow of slurry vi) material?
 - Gate valve a)
- Globe valve b)
- c) Plunger
- d) Diaphragm.



- vii) The sphericity of a cubical particle having length 3 mm is equal to
 - a) 3.0

b) 1.0

c) 1·274

- d) none of these.
- viii) A Newtonian fluid (density = ρ , viscosity = μ) is flowing in a smooth pipe with velocity v in a tube of dia D. Then pressure drop across the length L will be proportional to
 - a) $L \rho v^2 / D$
- b) $D \rho v^2 / L$
- c) $L \mu v / D^2$
- d) $\mu v/L$.
- ix) Power loss in an orifice meter is that in a venturimeter.
 - a) less than
- b) same as
- c) more than
- d) none of these.
- x) Fluidized bed are formed when
 - a) fluid friction is zero
 - b) gravity force is less than fluid friction
 - c) pressure force is equal gravity forces
 - d) sum of the fluid friction and pressure forces is equal an opposite to gravity forces.

- xi) For the laminar flow of a fluid in a circular pipe of radius *R*, the Hagen-Poissuille equation predicts the volumetric flow rate to be proportional to
 - a) *R*

b) R^2

c) R^4

- d) $R^{0.5}$.
- xii) Equivalent diameter of an annulus pipe having outer and inner radius 5 m and 3 m is given by
 - a) 10 m

b) 4 m

c) 6 m

d) none of these.

GROUP - B

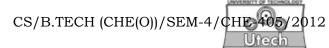
(Short Answer Type Questions)

Answer any *three* of the following.

 $3 \times 5 = 15$

- 2. Given that for fully developed lamina flow velocity distribution is given by $u = 2U\{1-(r/R)^2\}$. Show that friction factor (f) = 16/Re. U = average velocity.
- 3. Write the importance of kinetic energy correction factor for modification of Bernoulli's equation and find out an expression for kinetic energy correction factor α .
- 4. Derive Hagen-Poiseuille equation starting from average velocity distribution for laminar flow and find out the relation between friction factor of Reynolds No.
- 5. Find out the general expression for average velocity of Pseudoplastic fluid under laminar flow condition.
- 6. Prove that for laminar flow the average velocity is exactly one-half of maximum velocity for the same system.

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GROUP - C

(Long Answer Type Questions)

Answer any three of the following.

 $3 \times 15 = 45$

- 7. a) A U-tube manometer with mercury reads 12 cm water is in the pipeline. Express the pressure in N/m^2 . Density of mercury = 13600 kg/m³, density of water = 1000 kg/m^2 .
 - b) Write the Bernoulli's equation with friction and explain the significance of its each term.
 - c) A town delivers its water supply from a river pumping it with a standard pipe. The inlet to the pump is 5 m above the river and the water level in the pipe kept constant at 100 m above the pump discharge. The frictional loss is 1800 gmf cm/gm of water through the 2500 m of 25 cm I.D pipe which includes the total equivalent length of all piping from river to water tower. If the pump capacity is 20000 L/hr and pump is 80 efficient, then what should be the hourly pumping cost if electricity costs Rs. 4 per k watt-hr? 4 + 3 + 8
- a) With neat diagram give the difference between suction head and suction lift. Also write the mathematical expression for NPSH.
 - b) With neat diagram show the characteristic curves of a centrifugal pump.

- c) Drops of oil 15 micron in dia ore to be settled from their mixture with air. The sp gravity of the oil is 0.9 and the air is at 21°C and 1 atm pressure. A settling time of 1 min is available. How high should be chamber be to allow settling of a particle? (Viscosity at 21°C = 0.018 cp)
- 9. a) Find out an expression for a friction loss coefficient for sudden expanded cross section.
 - b) Water flows through a 200 mm dia pipe with an average velocity of 3.6 m/sec. There is a certain enlargement to a 400 mm dia pipe
 - i) What is the power loss due to the certain enlargement?
 - ii) What will be power loss if water flows into opposite direction with the same average velocity in the smaller pipe? 7 + 8
- 10. a) "The pressure drop across a fluidized bed always remain constant." Explain the statement.
 - b) Establish Kozeny-Carman equation to find out pressure drop in a packed bed.
 - c) What do you mean by minimum fluidization velocity? Calculate the minimum fluidization velocity from the given data. Porosity = 0.40, Particle diameter = 1.25 mm (spherical), Density difference = 0.25 g/cc, Fluid viscosity = 1 cp. 2 + 6 + 2 + 5

- 11. a) With a diagram explain how Rotameter functions?

 Show that pressure drop across the float is invariant with flow rate.
 - b) "The permanent pressure loss in a venturimeter is relatively small than that in a orifice meter." Elaborate the statement.
 - c) Flow of a liquid in a 75 mm diameter pipe is measured by an orifice. Maximum flow rate is limited to 10 litres in a second. The mercury manometer gives a reading of 35 cm at this flow rate. Estimate orifice size. Liquid density = 1200 kg/m³.
