Roll No. | | | | | | | | | | | | |

Total No. of Questions: 09 **Total No. of Pages: 02**

B. Tech. (CE) (Sem. 4)
FLUID MECHANICS-II
Subject Code: BTCE-404
Paper ID: A1174

Time: 3 Hrs. **Max. Marks: 60**

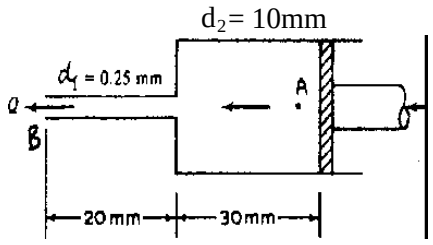
INSTRUCTIONS TO CANDIDATES:

1. **Section A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **Section B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **Section C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

1. Write briefly :
   a) What is the velocity gradient at the separation point of boundary layer?
   b) Define hydraulic radius in an open channel flow.
   c) What is the ratio of laminar sub-layer thickness to physical roughness for hydraulically rough pipe?
   d) In fully developed turbulent flow, if the diameter is halved without changing the flow rate, by what factor the frictional drop will change?
   e) Define Specific energy.
   f) In a rectangular open channel flow what is the ratio of critical depth to its specific energy?
   g) In a circular channel section what is the ratio of flow depth to diameter of circular section for flow to be maximum?
   h) Enlist the factors on which the manning's co-efficient depends.
   i) Define alternate depths.
   j) When a surge is to be said a positive surge?

SECTION B

2. In a syringe of figure, the drug has p = 900 kg/m3 and μ = 0.002 Pas. Determine the steady force required to produce a flow of 0.4 mL/s through the needle.



3. A lubricating oil of viscosity 0.03 Nsm^{-2} is delivered to a machine at a rate of 10^{-7} m^3s^{-1} through a convergent, tapered tube of length 50 cm with an upstream diameter of 10 mm and downstream diameter of 5 mm. Determine the pressure differential which will maintain the flow. Entrance and exit losses, and inertia effects due to the change in velocity in the tube, may be neglected.

4. Assuming the velocity distribution in the boundary layer as $\frac{u}{u_\infty} = \sin\left(\frac{\pi y}{2\delta}\right)$ (in the range $0 \leq y \leq \delta$ and $\frac{u}{u_\infty} = 1$ beyond δ). Determine the thickness of the boundary layer.

5. Derive an expression for loss of head in pipe flow at sudden expansion in diameter.

6. A Channel encounters a change in its bed slope. Derive an expression for change in its flow depth.

SECTION C

7. In the flow through a sluice in a large reservoir, the velocity downstream is 5.33 m/s while the flow depth is 0.0563 m. Determine the downstream conditions if a hydraulic jump takes place downstream. Calculate the energy dissipated in the jump.

8. A barrage is constructed across a wide river whose discharge is 6 m^3/sec/m and bed slope is 10 cm/km. If the afflux produced at the site of the barrage is 3 m, find the length of the water surface profile produced from the site of the barrage till a point where the water depth is 6.25m: Use the direct step method considering 3 points. Take Chezy coefficient C = 50.

9. Compute the critical depth ma trapezoidal channel for a flow of 30m^3 /s. The channel bottom width is 10.0 m, side slopes are 2H:IV, the bottom slope is negligible.