01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Magh

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCE, B.Agri.	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

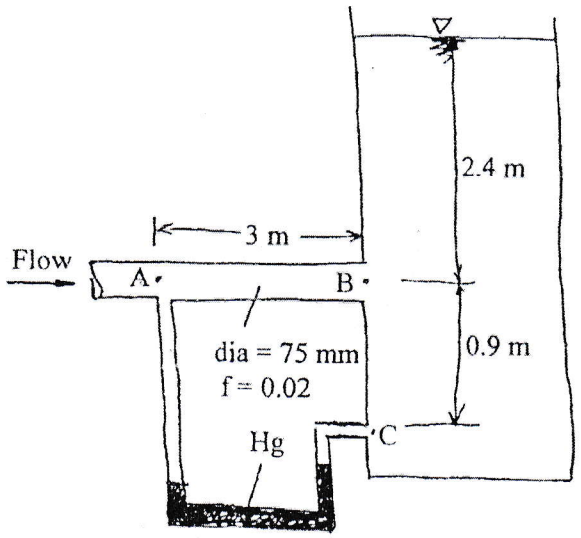
Subject: - Hydraulics *(CE555)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

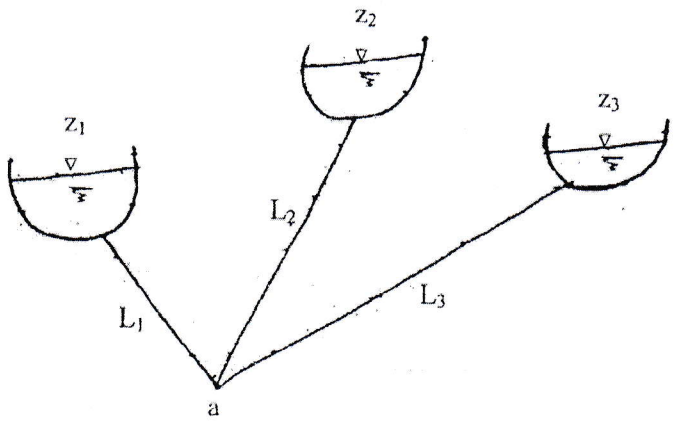
1. Show that in both smooth and rough pipes for turbulent flow $\frac{u-v}{v^*} = 5.75\log\left(\frac{y}{R}\right) + 3.75$

   Where v = mean velocity; u = point velocity at distance y from boundary. v^* = shear velocity; R = Radius of pipe. [8]

2. Calculate the magnitude and direction of the manometer reading when water is flowing with velocity of 4.5 m/s for figure below. Consider minor losses also. [8]



3.



For the three reservoir system of above figure, z_1 = 29 m, L_1 = 80 m, z_2 = 129 m, L_2 = 150 m, z_3 = 69 m and L_3 = 110 m. All pipes are 250 mm diameter concrete with roughness height 0.5 mm. Compute the flow rates for water. [10]

4. a) Define water hammer and write down continuity equation and momentum equation for unsteady flow in pipe. [3]

   b) A value is closed in 4.5 s at the down stream end of a 3200 m pipeline carrying water at 2.7 m/s, What is the peak pressure developed by the closure, if the wave travels with velocity of 1000 m/s? Determine the length of pipe subject to the peak discharge. [5]

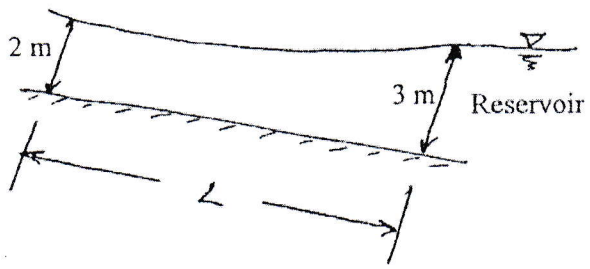
5. Given a practical example for each of the following open channel flow: (a) GVF (b) RVF (c) Spatially varied flow (d) Non uniform flow. [4]

6. a) Prove that for compound open channel, velocity distribution coefficient (Energy correction factor) $\alpha = \dfrac{\sum\left(\dfrac{K_i^3}{A_i^2}\right)\left(\sum A_i^2\right)}{\left(\sum K_i\right)^3}$, where k_i = Conveyance factor of i^{th} section, A_i = Cross section area of i^{th} section. [4]

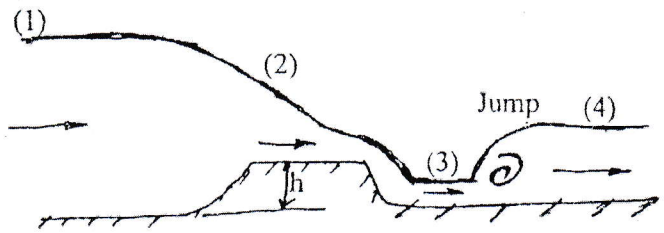
   b) Set up a general expression for wetted perimeter p_w of a trapezoidal channel in terms of the cross-sectional area A. depth y and angle of side slope ϕ. Then differentiate p_w with respect to y with A and ϕ held constant. From this, prove that R = y/2 for the section of greatest hydraulic efficiency (i.e, smallest p_w for a given A). [6]

7. What are the different conditions to be fulfilled when flow is critical open channel? A 3m wide rectangular channel carries 3 m^3/s of water at a depth of 1 m. If the width is to be reduced to 2 m and bed raised by 10 cm, what would be the depth of flow in the contracted section? What maximum rise in the bed level of the contracted section is possible without affecting the depth of flow upstream of transition? Neglect loss of energy in transition. What would be the change in water surface elevations if the rise in bed is 30 cm? [3+3+3+3]

8. The clean earth (n = 0.020) channel in figure below is 6m wide and laid on a slope of 0.005236. Water flows at $30m^3/s$ in the channel and enters a reservoir so that the channel depth is 3 m just before the entry. Assuming gradually varied flow, calculate the distance L. [8]



9. Water in a horizontal channel accelerates smoothly over a bump and then undergoes a hydraulic jump, as in figure below. If y_1 = 1 m and y_2 = 30 cm, estimate v_1, v_2 and y_4. Neglect friction. [6]



10. Describe the application of shield diagram for designing mobile boundary channel. [6]

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