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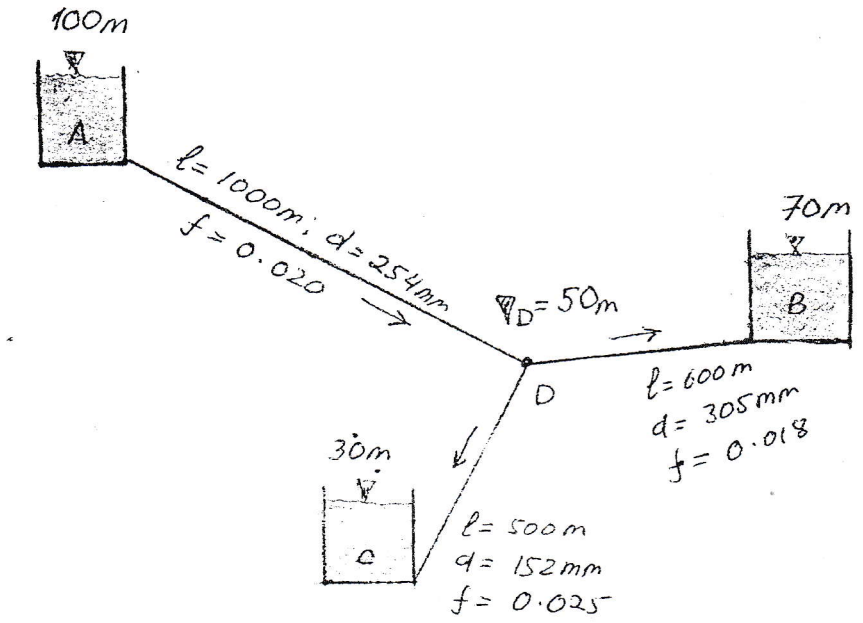
01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2074 Bhadra

Exam.	Regular		
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. Determine the discharge rate in each pipeline for the following three-reservoir problems. [10]



2. In a pipe of length 500 m and uniform circular cross-section, water flows at a steady velocity of 2 m/s and discharges to atmosphere through a valve. Under steady conditions the static head just before the valve is 300 m. Calculate the ratio of internal diameter to wall thickness of the pipe so that, when the valve is completely and instantaneously closed, the increase in circumferential stress is limited to 20 MPa, and determine the maximum time for which the closure could be described as rapid. The bulk modulus of water = 2 GPa, and the elastic modulus of the pipe material = 200 GPa. [8

3. Petrol of kinematic viscosity 0.6 mm^2/s is to be pumped at the rate of 0.8 m^3/s through a horizontal pipe 500 mm diameter. However, to reduce pumping costs a pipe of different diameter is suggested. Assuming that the absolute roughness of the walls would be the same for a pipe of slightly different diameter, and that, for $Re > 10^6$, f is approximately proportional to the cube root of the roughness, determine the diameter of pipe for which the pumping costs would be halved. Neglect all head losses other than pipe friction. How are the running costs altered if n pipes of equal diameter are used in parallel to give the same total flow rate at the same Reynolds number as for a single pipe? [8

4. Difference in level between two reservoir is 100 m and distance between them is 10 km. The reservoir is connected by a single pipe to carry 200 lps. Calculate the diameter of the pipe and length of second pipe, which is connected to increase the rate of flow by 5×10^6 lit/day with same diameter pipe. Take friction factor for all pipes 0.03. [8]

5. Define gradually varied, rapidly varied and spatially varied of flow with examples. [2×3]

6. A 3.5 m wide rectangular channel carries a discharge of 10 m^3/s at a depth of 1.75m. If the width of the channel is reduced to 2.25 m and bed level is lowered by 0.97 m, determine the difference in water level elevation between upstream and contracted section. Assume no energy loss. [8]

7. A circular culvert has a capacity of 0.5 m^3/s when flowing full. Velocity should not be less than 0.7 m/s if the depth is one-fourth the diameter. Assuming uniform flow, determine diameter and slope taking manning's n = 0.012. [7]

8. A rectangular channel carrying a discharge of 40 m^3/sec a 16m wide having slope 1/5000 and Manning's coefficient n = 0.024. The depth of flow in a particular section is 1.5 m. Find how far upstream of downstream of this section the flow depth is 2.5m. Determine the type of flow profile and using direct step method calculate the length of profile taking 3 steps for calculation. [10]

9. Define specific force. Derive momentum equation for rectangular channel section. Draw a hydraulic jump profile and indicate conjugate depths using the specific force diagram. [8]

10. Write down the design procedures of mobile boundary channel using maximum permissible velocity method with appropriate expressions. Also describe Shield's approach of predicting critical tractive force. [4+3]

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