01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 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. Show that for turbulent flow in rough pipes $\frac{V}{V^*} = 5.75\log\left(\frac{R}{K}\right) + 4.75.$ [8]

   Where,

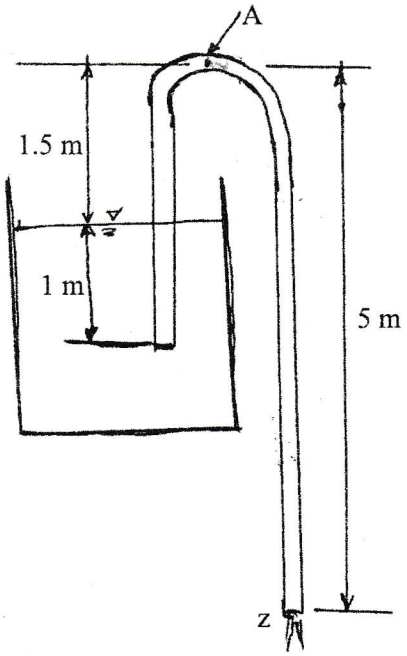
   V = Mean velocity

   V* = Shear velocity

   R = Radius of pipe

   K = Average height of surface protrusions

2. Liquid (s.g. = 0.6, $\nu = 5.0 \times 10^{-7}$ m^2/s) is drawn from a tank through a hose of inside diameter 25 mm (see figure). The relative roughness for the hose is 0.0004. Calculate the volumetric flow and the minimum pressure in the hose. The total length of hose is 9 m and the length of hose to point A is 3.25 m. Neglect minor losses at head entrance. [8]



3. Three reservoirs A, B and C are interconnected by three pipes which all meet at junctions J. The water surface of reservoir B is 20 m above the surface of C whilst the surface of A is 40 m above the surface of B. A flow control valve is fitted just before junction J in pipe AJ. [10]

   The head loss h_L through pipes and components can be written as $h_L = rQ^2$ where r is the resistance coefficient. The value of r for the valve and the pipes are $r_{AJ} = 150$, $r_{BJ} = 200$, $r_{CJ} = 300$, $r_{valve} = (400/n)^2$.

   Where n is the percentage valve opening. Find the value of n which will make the discharge into reservoir C twice into reservoir B.

4. a) Explain the importance of surge tank. Describe the types of surge tank. [1.5+1.5]

   b) A 300 mm diameter pipe of mild steel having 6 mm thickness carries water at the rate of 200 l/s. What will be the rise in pressure if the valve at the downstream end is closed instantaneously? Compare results assuming the pipe to be rigid as well as elastic. What should be the maximum closing time for the computed results to be valid? Take pipe length as 5.0 km, Modulus of elasticity of pipe material as 2.25×10^{11} N/m^2, Bulk modulus of elasticity of water as 2.0×10^9 N/m^2. [5]

5. Explain GVF, RVF and spatially varied flow with appropriate sketches. [4]

6. What condition make open channel flow uniform? The area of cross-section of flow in a channel is 6 m^2. Calculate the dimensions of the most efficient section if the channel is (a) triangular, (b) rectangular and (c) trapezoidal (2:1). Which has the least perimeter? [2+8]

7. a) A flow of 2 m^3/s is carried in a rectangular channel 1.8 wide at a depth of 1.0 m. Will critical depth occur at a section where (a) a frictionless hump 15 cm high is installed across the bed? (b) a frictionless sidewall reduces the channel width to 1.3 m? (c) the hump and the sidewall construction are installed together? [9]

   b) Define conjugate depths. Sketch the specific force curve showing conjugate depths and the zones of subcritical, critical and supercritical flow. [1+2]

8. A rectangular channel with a bottom width of 4 m, bottom slope of 0.00075 and energy correction factor of 1.1 has a discharge of 2.0 m^3/s. In a Gradually varied flow in this section the depth at certain location is found to be 0.2 m, considering Manning's roughness coefficient as 0.016 determine the type of GVF profile. How far upstream or downstream will the depth be 0.40 m from depth 0.20 m. Use Graphical Integration Method using increment equals to 0.1 m. [8]

9. For a hydraulic jump in a horizontal triangular channel show that $3Fr_1^2 = \frac{r^2(r^3-1)}{r^2-1}$,

   where $Fr_1^2 = \frac{v_1^2}{gy_1}$ and $r = \frac{y_2}{y_1}$. [6]

10. Write down the design procedures of mobile boundary channel using maximum permissible velocity method, tractive force method and regime theory approaches with appropriate expressions. [6]

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