01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Magh

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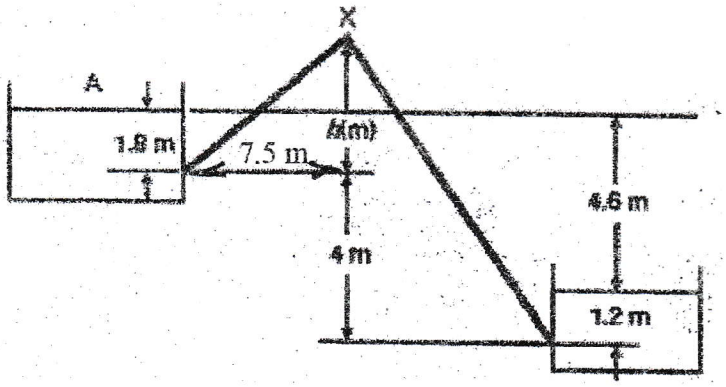
Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCE, B. Agri.	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

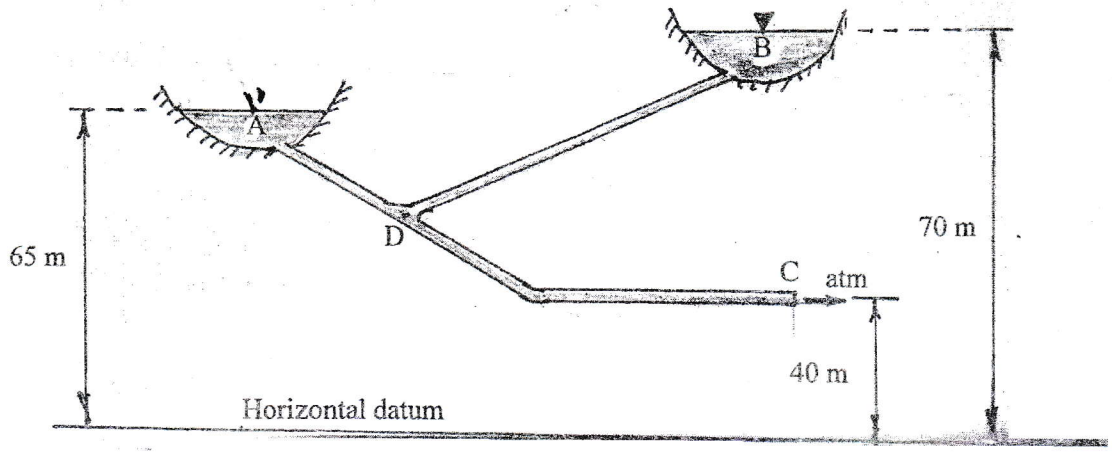
Subject: - Hydraulics *(CE555)*

- ✓ 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. Determine the size of steel pipe required to carry water at 30 *l*/s if the permissible energy gradient is 0.05. Will the boundary act as smooth or in transition? [8]
2. Two reservoirs are joined by a sharp-ended flexible pipe 100 mm diameter and 36 m long. The ends of the pipe differ in level by 4 m; the surface level in the upper reservoir is 1.8 above the pipe inlet while that in the lower reservoir is 1.2 m above the pipe outlet. At the position 7.5 m horizontally from the upper reservoir the pipe is required to pass over a barrier. Assuming that the pipe is straight between its inlet and the barrier and that f =0.04 determine the greatest height to which the pipe may rise at the barrier if the absolute pressure in the pipe is not to be less than 40kPa. Consider all losses. (Take atmospheric pressure = 101.3 kPa). [8]



3. In the reservoir system of figure Z_A= 65 m, Z_C = 40 m, Z_B = 70 m, BD = 900 m of 10 cm diameter pipe, AD = 600 m of 2.5 cm diameter pipe and DC = 150 m of 15 cm diameter pipe. Using f = 0.025 and neglecting minor losses, determine the flow in each pipe. [10]



4. Discuss water hammer phenomenon Describe with neat sketches, the one cycle pressure wave propagation in a pipe connected to a reservoir, when the valve is closed suddenly located at the end of pipe. [8]

   One cycle represents t = 0 to t = 4L/C

5. Define steady- nonuniform and steady- uniform flow hive at least two examples for each flow. [3]

6. a) Define hydraulic exponent. Show that the value of hydraulic exponent for triangular section is equal to 16/3. [4]

   b) A trapezoidal channel having side slope of 1:1 has to carry a flow of 15 m^3/s. The bed slope is 1 in 1000. Chezy's C is 45 if the channel is unlined and 70 if the channel is lined with concrete. The cost per m^3 of excavation is 3 times cost per m^2 of lining. Find which arrangement is economical. [6]

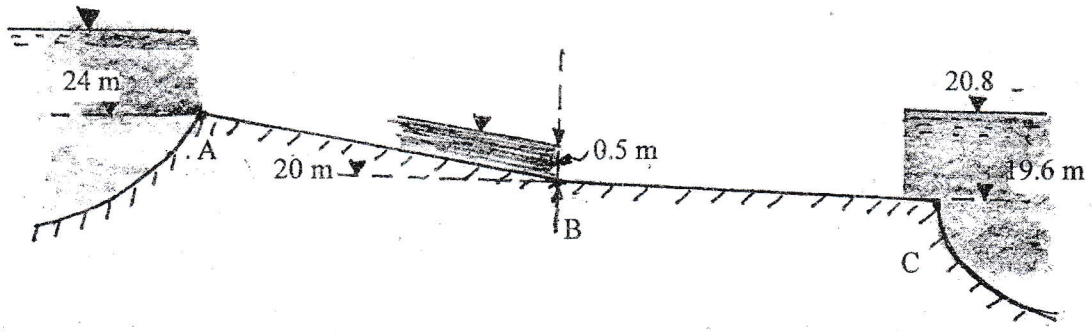
7. a) Find the expression for specific force and prove that when the specific force is minimum the flow is critical. [5]

   b) The width of a rectangular channel is reduced gradually from 3 m to 2 m and the floor is raised by 0.3 m at a given section. When the approaching depth of flow is 2.05 m, what rate of flow will be indicated by a drop of 0.2 m in the water surface elevation at the contracted section? [7]

8. What is a steep slope? Justify analytically the nature of surface profiles (both upstream and downstream end) for steep slope. [1+4]

9. Water is flowing from reservoir A to lake C via point B through a rectangular channel section of 4 m wide as shown in figure. The length of AB and BC are 100 m and the corresponding elevations are shown in figure. The normal depth above point B is 0.5 m taking Mapping's n = 0.025 and ignoring energy losses except in hydraulic jump.

   a) Determine the water surface elevation for upper reservoir. [3]
   b) Is there any possibility of formation of hydraulic jump? If so find the parameters of jump and its location. [4]
   c) Show all possible water surface profiles. [3]



10. With respect to design principle, distinguish between rigid boundary and mobile boundary channels. Explain the physical meaning of shear reduction factor "k" while designing mobile boundary channel. (no need derivation of any equation). [6]

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