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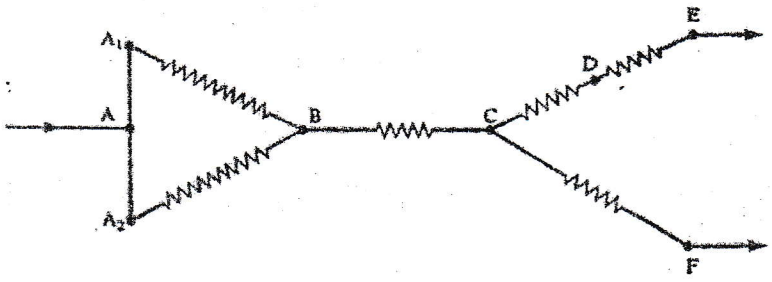
01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Baisakh

Exam.	Back		
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. A system of pipes conveying water is connected in parallel and in series as shown in figure below. The section DE represents the resistance of a valve for controlling the flow, which has a resistance coefficient $K_{DE} = \left(\frac{4000}{n}\right)^2$, where n is the percentage valve opening.



The friction factor f in the Darcy formula is 0.024 for all pipes, and their lengths and diameters are given by

Pipe	Length (m)	Diameter (m)
AA_1B	30	0.1
AA_2B	30	0.125
BC	60	0.15
CD	15	0.1
CF	30	0.1

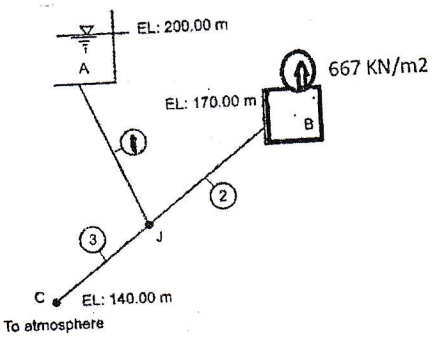
The head at A is 100m, at E is 40 m and at F is 60m. If the valve is adjusted to give equal discharge rates at E and F, calculate the head at C, the discharge through the system and percentage valve opening. Neglect all losses except those due to friction. [10]

2. A cast iron pipe of 300 mm diameter and 8 mm thick is 1500 m long. The pipe is to convey 200 litres per sec of water.
   a) Estimate the maximum time of closure of a valve at the downstream end that would be recognized as rapid closure?
   b) What is the peak water hammer pressure produced by rapid closure?
   c) What is the length of the pipe subjected to peak water hammer pressure if the time of closure is 2.0 sec? (For water E = 2200 MPa; for cast iron $E = 80 \times 10^9 Pa$) [2.5+2.5+3]

P.T.O.

3. For the reservoir system shown in figure, determine the flow in each pipe. At C, the pipe discharges into the atmosphere at a elevation of 140.00 m and at Tank B, the top is closed with pressure of 667 KN/m^2 of Hg. Take f =0.02 for all pipes and use following data: [8]

Pipe	Diameter	Length
1	15 cm	800 m
2	20 cm	500 m
3	30 cm	600 m



4. Pipes of 75 mm are to be used to syphon water from a main canal to branch canal, the difference of water level between the two canals being 15m. The length from the main canal to the summit of the pipe line is 20m. The total length of the pipe being 50m.

   a) Determine the number of pipes required to discharge at least 50 l/sec of water to the branch canal.

   b) Find also the maximum height of the summit above the water level of the main canal in order the pressure at the summit may not fall below 25 KPa (absolute). Take f = 0.03 and ignore minor loss. [4+4]

5. Explain variation of hydraulic radius with respect to depth in a very deep rectangular channel with suitable illustration. [6]

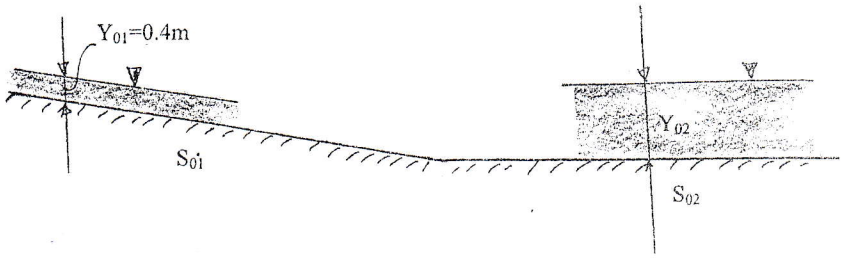
6. A 3m wide rectangular channel carries a discharge of 15m^3/s at a depth of 2 m. What will be the minimum height of hump at which the depth over the hump will be critical? Calculate the height of hump for which upstream water depth will be 2.5 m. What will be the depth of flow on the upstream and on the hump when its height is 0.2 m? [8]

7. A 3.6 m wide rectangular channel had badly damaged surfaces and had a Manning's n = 0.030. As a first phase of repair, its bed was lined with concrete with n = 0.015. If the depth of flow remains the same at 1.2 m before and after the repair, what is the increase of discharge obtained as result of repair. [7]

8. A rectangular channel section has a change in slope as shown in figure below. The channel is 4m wide having Manning's n = 0.0165. The bed slope So_2 = 0.0024 and the flowing discharge is 16 m^3/sec.

   a) Calculate the depth that must exist in the downstream channel for a hydraulic jump to terminate at uniform flow condition.

b) If upstream depth Y_{01} = 0.4m, calculate the length of hydraulic jump using at least three increments of depth in a step calculation. [5+5]



9. Draw a hydraulic jump profile and indicate conjugate depths and energy loss using specific energy and specific force diagram. Hence derive momentum equation for the hydraulic jump in rectangular channel. [8]

10. Distinguish between Rigid boundary and Mobile boundary channels with respect to design principle. Explain the procedures of designing rigid boundary channel by minimum permissible velocity approach. [3+4]

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