01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Bhadra

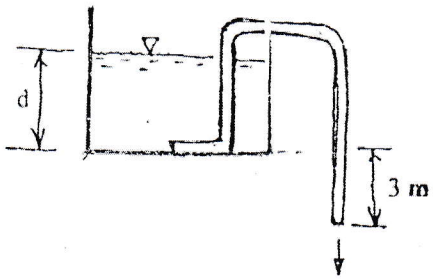
Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BCE, B.Agri.	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Hydraulics *(CE555)*

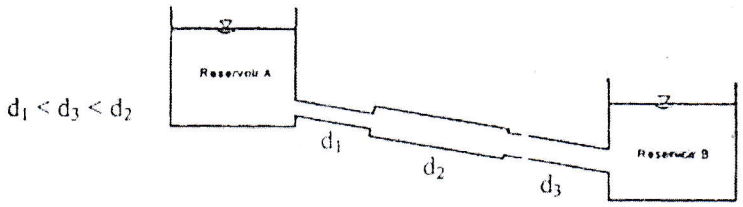
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ ***Moody diagram provided.***
- ✓ *Assume suitable data if necessary.*

1. A total 12 liters per sec of oil is pumped through 2 pipes in parallel, one 12 cm in diameter and the other 10 cm in diameter, both pipes 1000 m long. The specific gravity of oil is 0.85, average roughness height is 0.26 mm for both pipes and kinematic viscosity is 9 cm^2/sec. Calculate the flow rate through each pipe, and power generated by pump. [8]

2. a) Small swimming pool is drained with velocity of 1.2 m/sec using a pipe with hose diameter 20 mm, length 30 m, and absolute roughness e = 0.2 mm. Find the water depth "d" at instant shown in figure below considering minor head loss coefficient at entrance K = 0.5. [5]

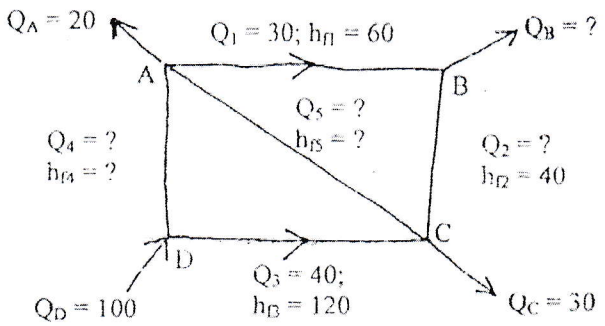


b) Draw HGL and EGL diagram for the flow system shown in the figure considering all major and minor losses. [1.5+1.5]



3. a) What do you understand by branching pipe system? Explain. Describe the solution procedures for three possible different cases of three reservoir problem. [6]

b) A pipe network is shown in figure in which Q and h represents the discharge and head losses respectively. Determine head losses and discharge indicated by a question mark, for this pipe network. [4]

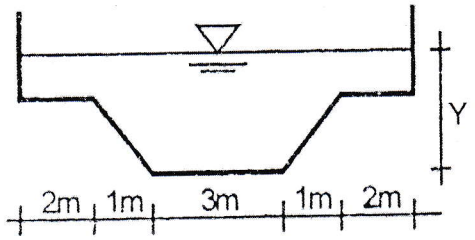


4. Water is flowing from a reservoir in a pipe of 600 mm diameter, 3000 m long and 6 mm thick at a velocity of 3.5 m/s. Assuming the value of bulk modulus of elasticity for water as 2.06 GPa, modulus of elasticity for pipe material 206 GPa and velocity of pressure wave 1400 m/s. Draw pressure-time diagram at location 1200 m from reservoir if the valve located at the end of the pipe is closed in 1 second. [8]

5. Define bed slope, hydraulic slope and energy slope. Why for non-uniform flow, these slopes are not parallel to each other, explain with neat sketch. [4]

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

   b) For given channel section shown in the figure below with bed slope = 0.00017, Manning's roughness coefficient = 0.018, discharge 8.97 m^3/s, and side slope as 1:1, determine the normal depth of flow for uniform flow. [6]



7. A rectangular channel with a bottom width of 5 m, bottom slope of 0.00076 and energy correction factor of 1.1 has a discharge of 1.85 m^3/s. In a Gradually varied flow in this section the depth at certain location is found to be 0.25 m, considering Manning's roughness coefficient as 0.0165 determine the type of GVF profile. How far upstream or downstream will the depth be 0.40 m from depth 0.25 m. Use direct step method using increment equals to 0.05 m. [8]

8. a) A 3.5 m rectangular channel carries discharge of 4 m^3/s of water at a depth of 1.2 m. If the width is reduced to 2.0 m and bed raised by 0.15 m, determine the depth of flow at reduced section and upstream of the reduced section. [6]

   b) Find the expression for the specific force. Show that the flow is critical when the specific force is minimum. Explain the use of this concept in open channel flow. [4+2]

9. A rectangular channel with width 1.1 m carrying a flow discharge of 7.2 m^3/s changes its bed slope from 0.065 to 0.0085. Show that the hydraulic jump occurs and if so find the location of jump. Take Manning's roughness as 0.025. [6]

10. Define an alluvial channel and incipient motion. Find the expression for the shear reduction factor "K" and explain the physical meaning of this factor. [1+3+2]

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