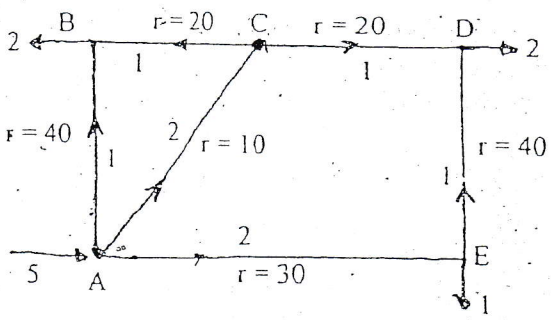
01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2068 Magh

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

Subject: - Hydraulics

- ✓ 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 2cm diameter 20km long pipeline connects two reservoirs filled with water open to the atmosphere. What is the discharge in the pipeline if the surface elevation difference of the reservoirs level is 5m? $\nu_{water} = 1.02 \times 10^{-6} m^2/s$. [8]
2. Explain the experiment made by Nikuradse on resistance to artificially roughened pipes. Discuss the characteristic features of the result obtained. [3+5]
3. For a pipe network shown in figure below, trial discharge distribution is shown, if n = 2 for all the pipes. Obtain the correct distribution. Find also the available pressure at C, if the supply pressure at A is provided by 6m high water tank. [8+2]

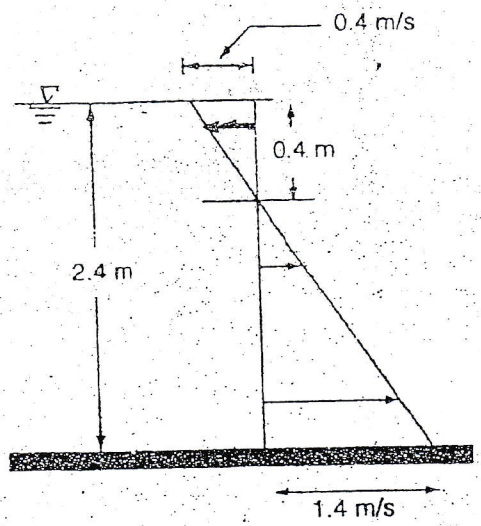


4. Derive following continuity equation for unsteady flow in pipes $\frac{1}{\rho}\frac{dp}{dt} + c^2\frac{\partial v}{\partial s} = 0$.

Where $c = \sqrt{\frac{k'}{\rho}}$ is celerity and other symbols have their usual meanings. [8]

5. Give one example of each of : [4]
   a) Steady, uniform flow
   b) Steady, non uniform or gradually varied flow
   c) Steady, rapidly varied flow
   d) Unsteady, non uniform flow

6. For the velocity distribution given in figure below, find energy and momentum correction factors. [4]



7. Establish the relationship between Darcy, Chezy and Manning's equations based on the shear stress distribution on the channel boundary for uniform flow. Explain the ways of estimating Manning's coefficient for composite channel boundary. [4+2]

8. Find at what bed slope a 4m wide rectangular channel be laid so that the flow is critical at a normal depth of 1.25m, with Manning's coefficient (n) = 0.015. [6]

9. A discharge of $16m^3/s$ flows with depth of 2m in a 4m wide rectangular channel. At a downstream section, the width is reduced to 3.5m and the channel bed is raised by 0.35m. To what extent will the surface elevation be affected by these changes? [6]

OR

Write algorithm and programme coding in any high level language (C or Fortran) for determination of critical depth in trapezoidal channel section.

10. A wide rectangular channel conveys a discharge of $5m^3/sec$ with a bed slope of 1 in 3600 with Manning's coefficient (n) = 0.02. If the depth at a section is 3.5m, determine how far upstream or downstream of the section, the depth would vary within 5% of the normal depth. Find the nature of profile and make calculation with direct step method and take only 2 steps for calculation. [7+1]

11. A vertical sluice gate with an opening of 0.67m produces a downstream jet depth of 0.4m when installed in a long rectangular channel 5m wide conveying a steady discharge of $20m^3/s$. Assuming that the flow downstream of the gate eventually returns to the uniform flow depth of 2.5m, [6]

a) Verify that a hydraulic jump occurs. Assume $\alpha = \beta = 1$
b) If the downstream depth is increased to 3m, analyze the flow conditions at the gate.

12. A stream has a sediment bed of median size 0.35mm. The slope of the channel is 1.5×10^{-4}. Stream is considered as trapezoidal with base width 3m and side slope 1.5H:1V. [6]

a) If the depth of the flow in channel is 0.25m, examine whether the bed particles will be in motion or not.
b) Calculate minimum size of gravel that will not move in the bed of channel. Use Emperical equation of critical shear stress as: $\tau_c\left(\frac{N}{m^2}\right) = 0.155 + \frac{0.409 d^2_{mm}}{\left[1 + 0.177 d^2_{mm}\right]^{1/2}}$

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