TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2076 Baisakh

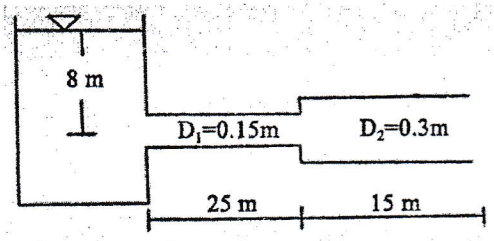
Exam.	Back		
Level	BE	Full Marks	80
Programme	BCE, BAG	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Hydraulics *(CE 555)*

- ✓ 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) A straight smooth pipe 100mm diameter and 60m long is inclined at 10^{o} to the horizontal. A liquid of relative density 0.9 and kinematic viscosity 120 $mm^2.s^{-1}$ is to be pumped through it into a reservoir at the upper end where the gauge pressure is 120 kPa. The pipe friction factor f is given by 64/Re for laminar flow and by 0.32 $(Re)^{-1/4}$ for turbulent flow when $Re < 10^5$. Determine (a) the maximum pressure at the lower, inlet, end of the pipe if the mean shear stress at the pipe wall is not to exceed 200 Pa; (b) the corresponding rate flow. [8]

   b) Draw the hydraulic gradient line (HGL) and total energy line (TEL) for the following with considering all losses of head. The pipe laid horizontal and discharge freely into the atmosphere. Take coefficient of friction(f)=0.01 [8]



2. a) A reservoir A feeds two lower reservoirs B and C through a single pipe 10 km long, 750 mm diameter, having a downward slope of $2.2x10^{-3}$. This pipe then divides into two branch pipes, one 5.5 km long laid with a downward slope of $2.75x10^{-3}$ (going to B), the other 3 km long having a downward slope of $3.2x10^{-3}$ (going to C). Calculate the necessary diameter of the branch pipes so that the steady flow rate in each shall be 0.24 $m^3.s^{-1}$ when the level in each reservoir is 3m above the end of the corresponding pipe. Neglect all losses except pipe friction and take f=0.024 throughout. [8]

   b) A pump draws water from a reservoir and delivers it at a steady rate of 115 L/s to a tank in which for free surface level is 12m higher than that in the reservoir. The pipe system consists of 30m of 225mm diameter pipe (f=0.028) and 100m of 150mm diameter pipe (f=0.032) arranged in series. Determine the flow rate 2s after a failure of the power supply to the pump, assuming that the pump stops instantaneously. Neglect minor losses in the pipes and in the pump, and assume an incompressible fluid in rigid pipes with f independent of Reynolds number. [8]

3. a) In a rectangular channel, F_1 and F_2 are the Froude's number corresponding to the alternate depths at a certain discharge. Show that: $\left(\frac{F_2}{F_1}\right)^{\frac{2}{3}} = \frac{2+F_2^2}{2+F_1^2}$ [4]

b) Define the terms energy slope, prismatic channel, non-prismatic channel and spatially varied flow. [4]

c) The flow depth and the flow velocity upstream of a 0.2-m sudden step rise in the bottom of a 5-m wide rectangular channel are 5m and 4 m/s respectively. Assuming there are no losses in the transition, determine:

i) The flow depth downstream of the step and the change in the water level;

ii) The flow depth and the water level downstream of the step if the channel bottom has a 0.2-m drop instead of the rise, as in (i). [4+4]

4. a) A sluice across a rectangular prismatic channel 6m wide discharges a stream 1.2m deep. What is the flow rate when the upstream depth is 6m? The conditions downstream cause a hydraulic jump to occur at a place where concrete blocks have been placed on the bed. What is the force on the blocks if the depth after the jump is 3.1m? [8]

b) Write an algorithm, flow chart and computer program in any high level language to determine normal depth in a trapezoidal channel. [8]

5. a) A dam is built across a channel of rectangular cross section which carries water at the rates of 8.75 m^3/s. As a result the depth just upstream of the dam is increased to 2.5m. The channel is 5m wide and the slope of the bed is 1 in 5000. The channel is lined with concrete (Manning's n=0.015). How far upstream is the depth within 100mm of the normal depth? [8]

b) A channel which is to carry 15 cumecs through moderately rolling topography on a slope of 0.0015 is to be excavated in coarse alluvium with 50% of particles being 5cm or more in diameter. Assume that channel is to be unlined and of trapezoidal section. Find suitable value of base width and side slope. Take internal frictional angle as 34° and ratio between bed shear stress and critical shear stress as 0.7. Use tractive force method. Also explain about river bed formation in alluvial stream. [5+3]

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