(12)

01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2069 Poush

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

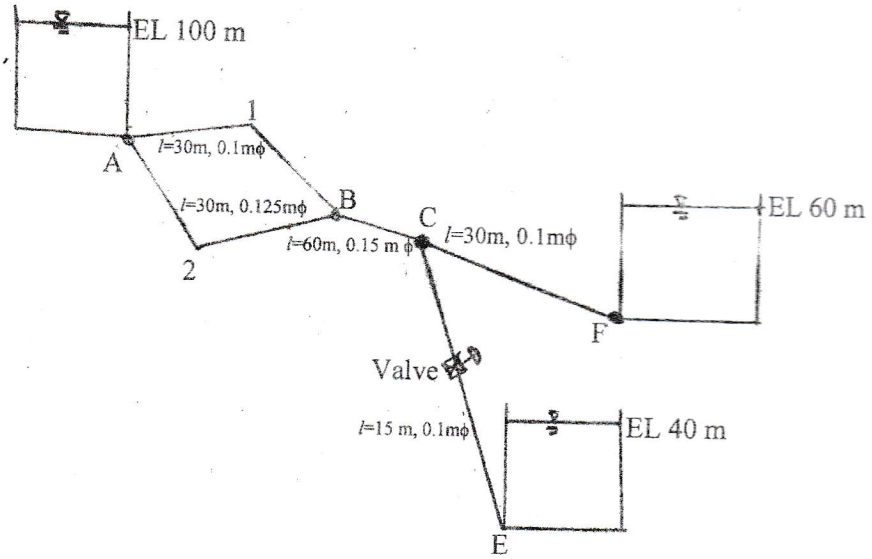
Subject: - Hydraulics *(CE 555)*

- ✓ 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.*

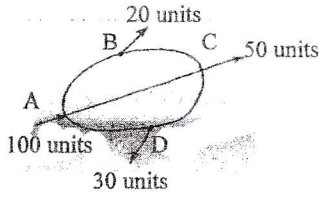
1. a) Measurement in a fully developed turbulent flow in pipe indicate that velocity midway between the pipe wall and the pipe centerline is 0.9 meters centerline velocity. Determine the expression for the average velocity in multiples of maximum velocity. What is the value of e/D or K/D (relative roughness) if pipe acts as rough pipe? [4]

   b) Write down Colebrook and white equation. Show that this equation is also valid for variation of friction factor for turbulent rough as well as smooth pipes. [4]

2. A system of pipes conveying water from the tanks is connected in parallel and series as shown in figure below. The elevations of tanks, lengths and diameters of the pipes are also shown figure. The valve is fitted on pipeline CE which has a resistance coefficient $r_{valve} = (4000/n)^2$, where n is the percentage of valve opening. If the valve is adjusted to give the equal discharge rates at E and F. Calculate the head at C, total discharge through the system and the percentage of valve opening. Take f = 0.024 for all pipes. [8]



3. Determine the distribution of flow in the pipe network show in figure below. The value of each pipe is as given below. use n = 2 ($h_f = kQ^n$). [10]



Pipe	Length m	Diameter mm.	Friction factor
AB	300	200	0.02
BC	250	150	0.03
CD	300	100	0.02
AD	250	150	0.03
AC	500	100	0.025

4. Describe with appropriate and enough illustrations one complete cycle of wave motion in a pipe due to sudden closure of valve. (You are required to show the direction of flow velocity and wave celerity at specified time periods). [8]

5. Define conveyance and section factor for the open channel. Also prove that hydraulic radius is equal to depth of flow for wide rectangular channel and half of the bed width for deep gorges. [1+1+1+1]

6. Find the proportions of a trapezoidal channel which will make the discharge a maximum for a given cross sectional area of flow and given side slopes. Show also that if the side slopes can be varied, the most efficient of all trapezoidal sections is half-hexagon. [10]

7. a) Calculate the critical depth for a discharge of 6 cumecs in the following section of channel: [8]

   i) Circular having diameter 1.5 m.
   ii) Rectangular having bed width 3m.
   iii) Trapezoidal having bed width 2.5 m and side slope 2:1
   iv) Triangular having side slope 1:1

   b) A uniform flow of $12m^3/s$ occurs in a long rectangular channel of 5 m width and depth flow of 1.5 m. A flat hump is to be built at a certain section. Assuming a loss of head equal to upstream velocity head, compute the minimum height of the hump to provide the critical flow. [4]

8. A rectangular channel 10m wide is laid with a break in its bottom slope from 0.01 to 0.0064. If it carries $125m^3/s$, determine the nature of the surface profile and compute its length. Take n = 0.015. [8]

9. Write algorithm and program coding in any high level language (C for Fortran) for computing alternate depths in a rectangular channel section. [6]

10. Derive an expression for the shear stress reduction factor or tractive force ratio in the case of mobile boundary channel in terms of side slope angle and angle of repose of the sediment. Also prove that the critical diameter of sediment in the channel for incipient motion condition assuming fully developed turbulent flow is: $d_{cr} = 10\ R\ S_o$, where R is hydraulic radius and So is bed slope. [4+2]

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