01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Ashwin

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

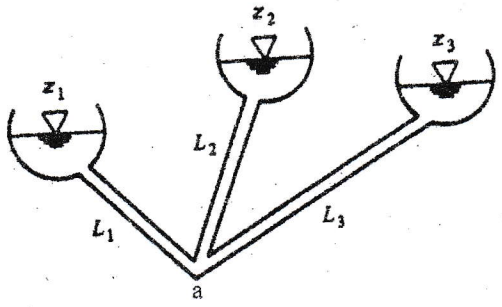
Subject: - Hydraulics *(CE555)*

- ✓ 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 horizontal pipe 60mm in diameter carries oil of specific gravity 0.8. The pressure difference between two sections 5km apart is found to be 200 kPa. The oil flowing through the pipe is collected in a tank. It is found that 1962 N of oil is collected in 4 minutes. Compute the dynamic viscosity of the oil. Assume the flow to be laminar and verify it. Also, find the velocity at a distance of 20 mm from the pipe wall. [4+2+2]

2. Two reservoirs are connected by a pipe 1000 m long of diameter 300 mm. The pipe passes over a hill whose height is 5 m above the level of water in the upper reservoir. The difference in water levels in the two reservoirs is 13 m. If the absolute pressure of water anywhere in the pipe is not allowed to fall below 1.2 m of water in order to prevent cavitations, calculate the length of pipe in the portion between the upper reservoir and the hill summit; and also the discharge through the pipe. Assume the reservoirs are open to the atmosphere having atmospheric pressure of 760 mm of mercury. Take friction factor, $f = 0.032$ and neglect bend losses. [8]

3. For the three reservoir system of figure below $Z_1 = 29$ m, $L_1 = 80$ m, $Z_2 = 129$ m, $L_2 = 150$ m, $Z_3 = 69$ m and $L_3 = 110$ m. All pipes are 250 mm diameter concrete with roughness height 0.5 mm. Compute the flow rates. Take $\upsilon = 1.02\times16^{-6} m^2/s$. You are not allowed to use the Moody's chart. [10]



4. Explain the water hammer phenomenon and mention its causes. Derive the momentum equation for unsteady flow through pipe. [3+5]

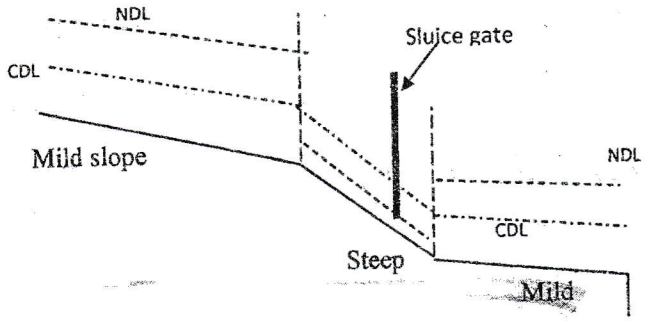
5. Define the following; non-perismatic channel, spatially varied flow, hydraulic slope, gradually varied flow. [4]

6. a) Determine the most economical section of a trapezoidal channel with side slope of 2:1, carrying a discharge of $9 m^3/s$ with a velocity of 0.75 m/s. Take Manning's $n = 0.025$. For conveying the same discharge, if a rectangular channel 1.2 m deep and 3 m wide is provided, what would be the saving in power per km length of channel? [4+2]

b) Using Manning's equation, show that the depth of flow is equal to 94% of the diameter for the partially filled most economical circular channel considering maximum discharge. [4]

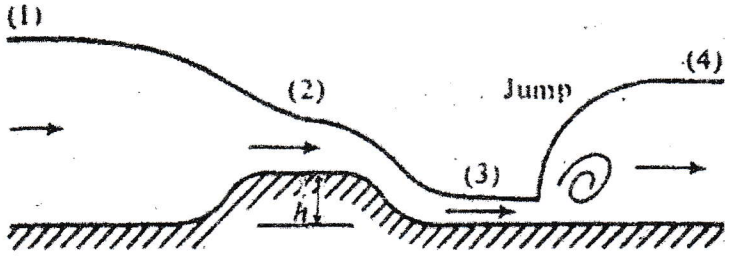
7. A trapezoidal channel of base width 6 m and side slope of 2 horizontal to 1 vertical carries a flow of 60 cumecs at a depth of 2.5 m. There is a smooth transition to a rectangular section 6 m wide accompanied by a gradual lowering of the channel bed by 0.6 m (i) Find the depth of water in the rectangular section and the change in water surface level. (ii) In case the drop in water surface level is to be restricted to 0.3 m. What is the amount by which the bed must be lowered? Assume no losses. [6+6]

8. a) Sketch the flow profile. [3]



b) Justify analytically the nature of surface profiles in critical sloped channels. [5]

9. Water in a horizontal channel accelerates smoothly over a bump and then undergoes a hydraulic jump as in figure below, if $y_1 = 1$ m, $y_3 = 30$ cm, estimate v_1, v_3, y_4 and bump height h. Neglect friction. [6]



10. a) Explain the Tractive Force Method of designing Mobile boundary channel. [3]

b) Design a regime channel for a discharge of 75 m^3/s and soil particle size of 0.65 mm using Lacey's method. Assume suitable side slope of channel. [3]

***