TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2076 Bhadra

Exam.	Regular		
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) Test on a 500 mm diameter commercial pipe indicated that head loss in 100 m length of pipe at different discharge of water is as given below.

Q (l/s)	40	200	400	800
h_f (m)	0.01	0.210	0.820	3.27

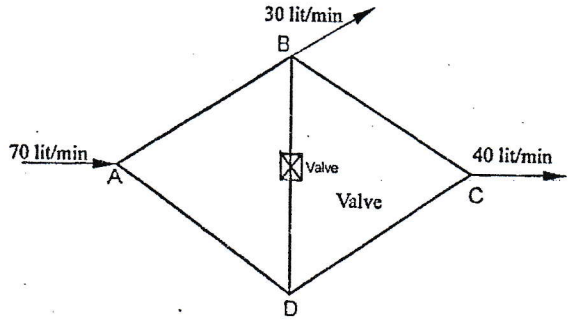
(i) Determine the equivalent sand grain roughness of the pipe.
(ii) What is the maximum water discharge at which this pipe will act as smooth pipe?
(iii)What is the maximum discharge at which this pipe will act as rough pipe? [6]

b) A fluid of constant density ρ enters a horizontal pipe of radius R with uniform velocity V and pressure p_1. At a downstream section the pressure is p_2 and the velocity varies with radius r according to the equation $u = 2V\{1 - \{r^2 / R^2\}\}$. Show that the friction force at the pipe walls from the inlet to the section considered is given by $\pi R^2\left(p_1 - p_2 - \frac{\rho V^2}{3}\right)$ [6]

c) A pipe line system consists of the following sources of head losses.
(i) Entrance loss in 200 mm diameter
(ii) Friction loss in 500 m of 200 mm diameter pipe with f = 0.02
(iii)Sudden expansion from 200 mm to 250 mm diameter
(iv)Exit loss from 250 mm diameter pipe
Obtain the equivalent length of 200 mm diameter pipe with f = 0.02. [4]

2. a) Determine discharge distribution in the pipes shown in the figure using hardy cross method. [10]

Pipes	AB	BC	CD	AD	DB	Valve
Resistance coefficient (r)	1	2.5	1.5	2	3	1.5



b) A valve which normally operates under a net head of 300m is supplied with water at 2.5 m^3/s through a pipe 1m diameter and 1.6 km long for which f = 0.02. When the valve is gradually stopped over an interval of 8 seconds, the retardation of the water being proportional to $t^{5/4}$ i.e. $a \propto t^{5/4}$, where t represents the time measured from the beginning of the shut-down. Neglecting minor losses and assuming an incompressible fluid in a rigid pipe with f independent of Reynolds number, determine the head at the valve inlet and the velocity in the pipe at t = 6 seconds. [6]

3. a) Differentiate between pipe flow and open channel flow. Also, define non-uniform open channel flow with examples. [1+2]

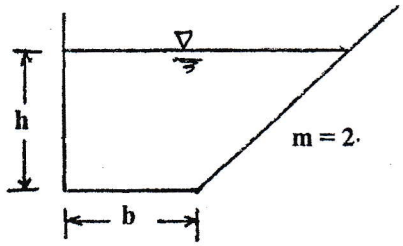
   b) Show that the minimum specific energy (E_c) is 5/4 times the critical depth (y_c) for triangular channel. [6]

   c) A rectangular channel 2m wide carries 3 m^3/s of water at a flow depth of 1.5m. What is the maximum height of the obstruction placed across the channel that will not cause a rise in the water surface upstream? [7]

4. a) If y_1 and y_2 are alternate depths in rectangular channel show that specific Energy

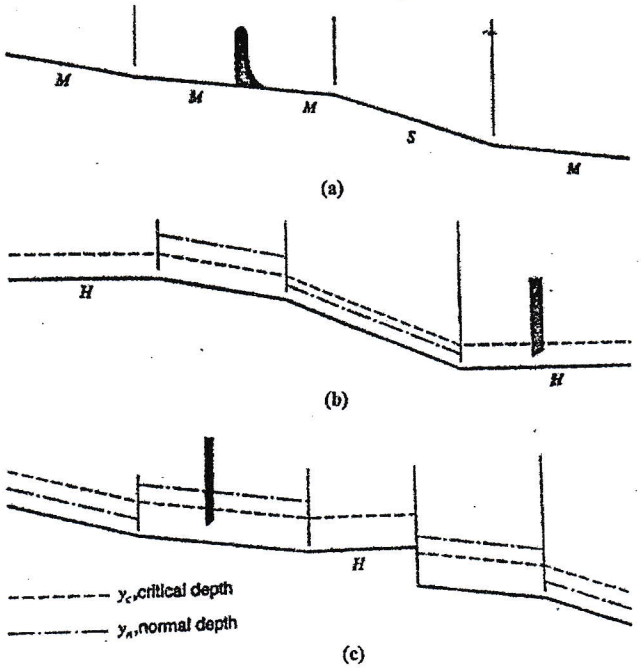
$$E = \frac{y_1^2 + y_1 y_2 + y_2^2}{(y_1 + y_2)}$$ [6]

   b) If the channel in the figure is to deliver 10 m^3/s when laid on a slope of 0.0001, calculate dimensions of the efficient section which require minimum lining. Take n = 0.015. [8]



   c) The longitudinal bed slope of Seti River is 10cm to a kilometer with hydraulic mean depth of 2.5m. Find; Chezy's coefficient and Manning's rugosity coefficient, if the velocity at the peak flood is measured to be 2.4 m/s. [2]

5. a) Sketch possible water surface profiles for the channel in figure. First locate and mark the control points, then sketch the profiles, marking each profile with appropriate designation. Show any hydraulic jumps that occur. [3+3+4]



   b) Discuss Shield's diagram and its application in designing mobile boundary channel. [6]

***