01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2069 Bhadra

Exam.	Regular (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCE	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. Describe with appropriate expressions (a) Prandtl's mixing length theory (b) Hagen poisseuille equation (c) Nikuradse's experiments and (d) Colebrook-white equation. [8]
2. Two pipes have a length L each. One of them has diameter D_1 and the other has diameter D_2. If the pipes are arranged in parallel, the loss of head when a total quantity of water Q flows through them is H_1. If the pipes are arranged in series and the same quantity Q flows through them, the loss of head is H_2. If $D_2 = D_1/2$, find the ratio of H_1 to H_2, neglecting minor losses and assuming same f. [8]
3. A reservoir A discharges through a pipe 450mm in diameter and 900m long which is connected to two pipes, one 1200m long leading to reservoir B 36m below A and the other 1500m long leading to reservoir C 45m below A. Calculate the diameters of these two pipes if they have equal discharges which together equal that of a 450mm diameter pipe of length 2100m connected directly from reservoir A to reservoir B. Neglect all losses except those due to friction and assume that the friction factor f is the same for all pipes. [10]
4. Derive an expression for the pressure rise due to instantaneous closure of valve considering the pipe to be elastic. From the derived expression for elastic pipe, obtain the pressure rise for rigid pipe. [7+1]
5. Explain Gradually varied and spatially varied flow with one practical example for each. [4]
6. a) Develop the relationship between Chezy's coefficient, Manning's coefficient and Darcy's coefficient. [4]

   b) A rectangular channel 8m wide and 1.5m deep has a slope of 0.001 and in lined with smooth plaster. It is desired to enhance the discharge to a maximum by changing the dimension of the channel, but keeping the same amount of lining. Work out the new dimension and the percentage increase in discharge.. Take roughness coefficient n = 0.015. [6]
7. What is specific force? Prove that for a given specific force the discharge in a given channel section is maximum when the flow is in the critical state. A venturiflume in a rectangular channel of width of "B" has the throat width of 'b'. The depth of liquid at entry is H and at the throat is h. Prove that following relation exists for the discharge and width ratio: [2+4+3+3]

$$Q = 3.13bH^{3/2}\left(\frac{h}{H}\right)^{3/2}$$

$$\frac{b}{B} = \sqrt{3}\left(\frac{h}{H}\right) - \sqrt{3}\left(\frac{h}{H}\right)^{3/2}$$

8. Derive the dynamic equation of Gradually varied flow (GVF) and convert the derived equation for the case of wide rectangular channel, using Manning's equation, into following form: [8]

$$\frac{dy}{dx} = \frac{S_0\left[1-(y_n/y)^{10/3}\right]}{1-(y_c/y)^3}$$ Where S_0 = bed slope, y_n = normal depth, y_c = critical depth.

9. Draw a hydraulic jump profile and indicate depths and energy loss using specific energy and specific force diagram. Also derive momentum equation for the hydraulic jump in rectangular channel. [6]

10. A trapezoidal channel 1.5m deep, 10m bed width, with 2:1 side slopes is excavated in gravel of median size of 60mm. What is the maximum permissible channel slope and what discharge can the channel carry without disturbing its stability? Take angle of repose(ϕ) = 37° and K_2 = 0.9. [6]

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