B.E. Seventh Semester (Civil Engineering) (C.B.S.)

Elective - I : Advanced Hydraulics

P. Pages : 2 **NKT/KS/17/7437**

Time : Three Hours * 0 0 9 6 * Max. Marks : 80

Note : Due credit will be given to neatness and adequate dimensions.

1. a) How you co-relate the manning's and Chezy's formula for uniform flow. **4**

b) An earthen trapezoidal channel (n = 0.025) has a bottom width of 5.0 m, side slopes of 1.5 H : 1 V and a uniform flow depth of 1.1 m. In an economic study to remedy excessive seepage from the canal two proposals, viz (a) to line the sides only and (b) to line the bed only are considered. If the lining is of smooth concrete (n = 0.012), determine the equivalent roughness in the above two cases. **9**

OR

2. a) Explain the features of the most common type of flow profiles. **5**

b) A rectangular channel with a bottom width of 4.0 m and a bottom slope of 0.0008 has a discharge of $1.50\,m^3/sec$. In a gradually varies flow in this channel, the depth at a certain location is found to be 0.30 m. Assuming n = 0.016, determine the type of GVF profile. **8**

3. a) Show that for a wide rectangular channel the slope is mild or steep according to S_o being less than or greater than $\left[\frac{n^2 g^{10/9}}{q^{2/9}}\right]$. **6**

b) A rectangular channel 2.0 m wide (n = 0.015), carries a discharge of $4.0\,m^3/sec$. The channel is laid on slope of 0.0162. A downstream sluice gate raises the water surface to 7.0 m immediately behind it. Find the transitional depth. **8**

OR

4. A trapezoidal channel has a bed width B = 5.0 m, $S_o = 0.0004$, side slope m = 2H : 1V and n = 0.02. The normal depth of flow $y_a = 3.0\,m$ if the channel empties into a pool at the downstream end and the pool elevation is 1.25 m higher than the canal bed elevation at the downstream end, calculate and plot the resulting GVF profile. Assume $\alpha = 1.0$. **14**

5. a) What are the characteristics of Jump in a rectangular channel? **5**

b) A rectangular channel carrying a supercritical stream is to be provided with a hydraulic Jump type of energy dissipator. If it is desired to have an energy loss of 5.0 m in the Jump when the inlet froude number is 8.5. determine the sequent depth. **8**

OR

6. A rectangular channel is laid on a slope of 1 H : 0.15 V. when a discharge of $11.0\,m^3/s/m$ width is passed down the channel at a depth of 0.7 m a hydraulic Jump is known to occur at a section. Calculate the sequent depth, length of the Jump and energy loss in the Jump. What would be the energy loss if the slope was zero? **13**

7. a) What are the various stages of a water hammer pressure wave? Show by diagrams. **5**

b) A cast iron pipe ($E = 1.0 \times 10^{11}$ pa) is 0.90 m in diameter and carries water ($K = 2.0 \times 10^{9}$ pa) at a velocity of 2.60 m/sec. A valve in this pipe is instantaneously closed bringing the flow to a sudden stop at the valve end. Estimate the water hammer head produced due to this action. The pipe thickness is 1.25 cm and the pipe can be treated as elastic. **8**

OR

8. A steel pipe 1.20 m in diameter conveys $1.40\,m^3/s$ of water under a head of 300 m. A valve at the downstream end can be expected to close suddenly. Estimate the water hammer pressure due to the closure. Also determine the minimum thickness of the wall to the nearest millimeter needed to with stand the pressures involved. for steel $E = 210\,kN/mm^2$ and safe working stress = $0.1 kN/mm^2$ for water $K = 2.10\,kN/mm^2$. **13**

9. A 2800 m long pipeline conveys water at a velocity of 2.0 m/sec. If a valve at the downstream end is closed suddenly. Calculate the maximum pressure rise. sketch the variation of the water hammer pressure with time at **13**

i) the valve end
ii) mid point B of the pipe
and iii) at point C2100 m. upstream of the valve.

The pipe starts from a lake at the upstream end. Assume the pipe to be rigid. For water, take $E = 1.956 \times 10^{9}$ Pa.

OR

10 Write short notes on. **13**

i) Water hammer pressures in pumping system.

ii) Application of allievi's method.

iii) Protection from water hammer pressures.

11. Write short notes on : **14**

i) Different types of surge tanks and function of surge tank.

ii) Analysis of flow in a simple surge tank system.

OR

12. The Tallulah Falls project in USA has a surge tank at the end a 2030 m long tunnel = $4.22 m\phi$. The surge tank which is rectangular in section, may be presumed to be of circular cross section, $15.85 m\phi$. The penstock system consists of 5 penstocks each $1.525 m\phi$ and 380 m long. These can be represented by a single penstock, 380 m long and $3.41 m\phi$. Friction factor for tunnel is 0.018 and for penstock 0.03. The acoustic wave velocity in the penstock is $1370 m/sec$. In steady state, the head reservoir level is EL 457.00 with a discharge of $26.2 m^3/sec$. Compute the water hammer pressure for a sudden closure. **14**

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