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

Elective - I : Advanced Hydraulics

P. Pages : 2 **KNT/KW/16/7437**

Time : Three Hours Max. Marks : 80

Notes :
1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.
8. Due credit will be given to neatness and adequate dimensions.
9. Assume suitable data whenever necessary.
10. Diagrams and chemical equations should be given whenever necessary.
11. Illustrate your answers whenever necessary with the help of neat sketches.
12. Use of non programmable calculator is permitted.

1. a) Differentiate convergence factor and section factor in case of open channel flow. What is their significance and where are these useful. **6**

b) A flow of $30\,m^3/sec$ is carried in a 5m wide rectangular channel at a depth of 1.0m. Find the slope necessary to sustain uniform flow at this depth, if Manning's N = 0.015. What change in roughness would produce uniform critical flow at this discharge on the calculated slope. **7**

OR

2. a) Derive the dynamic equation of gradually varied flow in terms of normal depth and critical depth by using Manning's equation. **7**

b) By taking suitable examples, draw **6**

i) M_2 and S_2 profile ii) M_3 profile iii) H_3 profile

3. a) Explain direct step method of computation GVF in rectangular channel. **6**

b) Describe in brief Chow's method of integration of GVF equation and list the assumptions made in it. **7**

OR

4. A rectangular channel 5.0m wide carries water at a depth of 2.5m. The bed slope is 0.0001 and chezy's C=45.0. The channel ends in free over fall. Find how for up stream of the fall the depth of flow would be 2.4m. Use Bresse's method and take three steps. **13**

5. a) What do you mean by hydraulic jump. On which situation it is developed. Whether it is a beneficial phenomenon or not. **6**

b) In a hydraulic jump occurring in a horizontal rectangular channel, it is desired to have an energy loss equal to 6 times the super critical flow depth. Calculate the Froude's number of flow necessary to have this jump. **8**

OR

6. a) Derive an expression for loss in energy loss through a hydraulic jump. **5**

b) What do you mean by stilling basins. Why are they provided. What are the various types of stilling basins according to Indian standards. Draw any one of it. **9**

7. a) What is a difference between elastic column theory and rigid column theory. **6**

b) Calculate the velocity of pressure wave along a circular pipe of 80mm thickness carrying water. Diameter of the pipe is 1.0m and take E for pipe material $25\,kN/mm^2$ and K for water is $2.1\,kN/mm^2$. **8**

OR

8. a) What is the difference between gradual closure and sudden closure of valve. What are expressions for pressure rise in the pipe in both the cases. **6**

b) A 200 mm diameter, 2000 m long pipe loads from a large reservoir to an outlet which is 20m below the water level in the reservoir. If the valve at outlet is suddenly opened, estimate the time required to reach 60% of V_0 and 95% of V_0, if friction factor is 0.03 and minor loss constant 6.0 **8**

9. Water is to be drawn from a storage reservoir having water surface elevation at 100.0m to the service reservoir having water surface elevation at 80.0m through a 1000mm diameter 12 km long pipe line under gravity. Maximum discharge through the pipe line is $1.2m^3$/sec and is controlled by a valve fitted at the service reservoir. The valve closes in 120 second, such that the discharge in the pipe line varies to the low **13**

$$Q = 1.2 \cos\left(\frac{\pi t}{240}\right)$$

Where t is time elapsed after closing of valve starts. Assuming that rigid water column theory is applicable. Calculate the maximum water hammer and also pressure at the valve, where t = 60 sec, Assume f = 0.015.

OR

10. a) Explain the effect of water hammer on a pipe line, how is it controlled to save the pipe line against water hammer pressure. **6**

b) Explain with the help of sketch, the variation of pressure with time due to sudden closure of valve fitted at the end of horizontal pipe supplied from a reservoir at the following location: **7**

i) At a point just U/S of the valve

ii) At a point located at distance x from the valve on the U/S side.

11. A 800 mm pipe of 1000m long supplies water under gravity from a storage reservoir having water surface elevation 10.0m above the valve fitted at the other end. The maximum discharge through the pipe, when the valve is fully opened is 1.0 m^3/sec. The valve closes in 10 sec such that the area of opening of valve decrease linearly. Calculate the maximum pressure rise using Allevi's interlocked equations. Assume E for steel $= 2 \times 10^5\,N/mm^2$ and K for water $2100\,N/mm^2$. Neglect frictional losses. **13**

OR

12. a) Explain the phenomenon of pressure wave reflection at the reservoir end and at the dead end in a single horizontal pipe. **6**

b) Starting from general solution of the water hammer equation for flow in a frictionless horizontal pipe, derive Allivi's inter locked equation for computation of water hammer pressure for slow closure of valve. **7**

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