(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 0026 Roll No.



## B. Tech.

## (SEM. IV) THEORY EXAMINATION 2010-11

## HYDRAULICS & HYDRAULICS MACHINES

*Time : 3 Hours* *Total Marks : 100*

Note :– Attempt *all* questions. All symbols have usual meanings.

1. Attempt any **FOUR** of the following :— (4×5=20)

(a) Differentiate between :—

(i) Uniform flow and nonuniform flow.

(ii) Gradually varied unsteady flow and spatially varied flow.

(b) Discuss velocity distribution of a rectangular open channel and draw its typical velocity profile.

(c) Show that for narrow deep rectangular channel 'R' is approximately equal to 'B/2'.

(d) Show that for channels with large slope, pressure variation with depth is given by

$$p = \gamma y \cos^2 \theta.$$

(e) At a section in a channel expansion the velocity over a quarter of the cross-section is zero and is uniform over the remaining three fourth of the area. Find out Kinetic energy correction factor.

(f) A rectangular channel 2·0 m wide has a specific energy of 1·50 m when carrying discharge of 6·32 $m^3$/sec Calculate the alternate depths and corresponding Froude's number.

2. Attempt any TWO of the following :— (2×10=20)

(a) A trapezoidal channel excavated in earth has to carry a discharge of 5·0 $m^3/s$ at a velocity of 0·75 m/s. The channel is 5·0 m wide at base and side slope of 1 : 1. At what slope should it be l[illegible] ? Take n = 0·02.

(b) The cross-section of a channel is as shown in Fig. 1. If S = 0·0004 and C = 80. Find discharge.

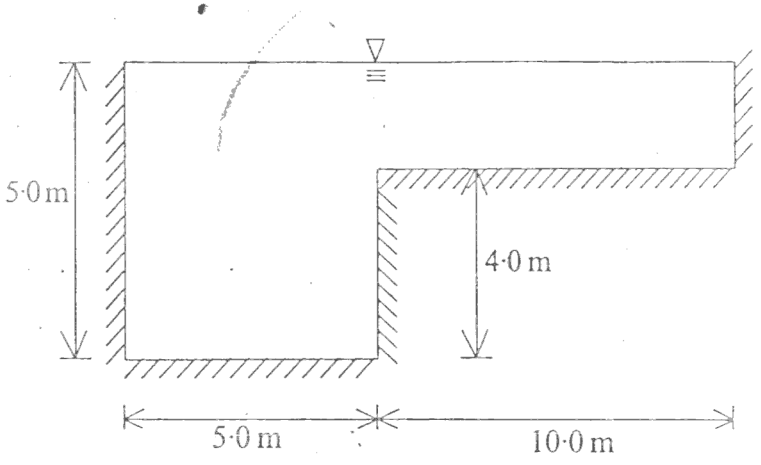


**Fig. 1**

(c) Show that for a rectangular channel carrying constant discharge, the specific force is minimum, when the depth is critical.

3. Attempt any **FOUR** of the following :— (4×5=20)

(a) Sketch flow profile of following case :

(i) mild slope to steep slope.

(ii) mild slope to adverse slope.

(b) Derive the equation for flow profile of GVF.

(c) Using basic differential equation of GVF, show that dy/dx is positive for $S_1$, $M_3$ and $S_3$ profiles.

(d) Discuss graphical method of integration of varied flow.

(e) A rectangular channel is 20 m wide and carries discharge of 65 $m^3/s$. It is laid at a slope of 0·0001. At a certain section along the channel length, the depth of flow is 2·0 m. How far will the depth be 2·60 m ? Take n = 0·02.

(f) Discuss various possible end conditions in a outflow of a canal into a lake.

4. Attempt any **TWO** of the following :— **(2×10=20)**

(a) (i) What is hydraulic jump ? Discuss some of its uses.

(ii) Classify hydraulic jumps based on Froude number.

(b) Show that in the case of a hydraulic jump in a triangular channel, the depths $y_1$ and $y_2$ are related by equation

$$\frac{1}{3}\left(\frac{y_2^3}{y_1^3}-1\right)=F_1^2\left(1-\frac{y_1^2}{y_2^2}\right)$$

in which $F_1^2=\dfrac{Q^2}{g A_1^2 y_1}$.

(c) A rectangular channel 4·0 m wide carries a discharge of 12·0 $m^3/s$ at a detph of 2 m. Calculate the height and velocity of a surge produced when the flow is suddenly stopped by the complete closure of a sluice gate at the downstream end.

5. Attempt any **TWO** of the following :— **(2×10=20)**

(a) (i) Define and explain hydraulic efficiency mechanical efficiency and overall efficiency of a turbine.

(ii) Differentiate between — Impulse and reaction turbine; Radial and axial flow turbine.

(b) The internal and external diameters of an outward flow reaction turbine are 2 m and 2·75 m respectively. The turbine is running at 250 rpm and rate of flow of water through the turbine is 5 $m^3$/sec. The width of runner is constant at inlet and outlet and is equal to 25 cm. The head at turbine is 150 m. Neglecting thickness of vanes and taking discharge radial at outlet, determine :

(i) vane angle at inlet and outlet.

(ii) velocity of flow at inlet and outlet.

(c) A single acting reciprocating pump running at 30 rpm, delivers 0·012 $m^3$/sec of water. The diameter of the piston is 25 cm and stroke length 50 cm. Determine

(i) theoretical discharge of pump

(ii) coefficient of discharge

(iii) slip and percentage slip of pump.