Total Pages—6

M.Tech-2
OCH/WRE

Set-1

OPEN CHANNEL HYDRAULICS

Full Marks : 70

Time : 3 hours

Answer **Q. No. 1** which is compulsory and any **five** from the rest

The figures in the right-hand margin indicate marks

1. Answer the following questions : 2 × 10

(*a*) Water flows in a rectangular channel 1·0 m wide at a depth of 0·10 m and a velocity of 1·5 m/s. Find the state of flow. $\nu = 10^{-6}$ m²/s.

(*b*) What is antidunes ?

(*c*) A steep rectangular channel has a slope of 30° with the horizontal. At a section the bed is 1·2 m above the datum, the depth of flow is 0·70 m and the discharge is 3·10 m²/s per meter width. The total energy head at that section by assuming $\alpha = 1{\cdot}2$ is.

(Turn Over)

(*d*) What is critical tractive force approach ?

(*e*) What is conveyance of a channel ?

(*f*) What is secton factor ?

(*g*) Sketch the possible water surface profiles for steep slope followed by a critical slope and a mild slope.

(*h*) Give examples of unsteady GVF and unsteady RVF.

(*i*) The sequent depth ratio in a hydraulic jump formed in a horizontal rectangular channel is 15. The Froude no of the supercritical stream is.

(*j*) If the depth of flow in a channel is 1 m and velocity of flow is 2 m/s, then the velocity with which an elementary wave can travel upstream is.

2. (*a*) What are the assumptions for GVF ? Derive the equation for GVF. 5

(*b*) An earthen channel with a base width 3 m and side slope 1 H : 2V carries water with a depth of 1·2 m. The bed slope is 1 in 1000. Calculate the discharge if $\eta = 0{\cdot}03$. Also calculate the average shear stress at the channel boundary. 5

3. (*a*) Derive one dimensional momentum equation using control volume approach. 4

(*b*) Find the depth of flow at which sediment of 1 mm diameter starts moving in a wide rectangular channel set at a slope of 10^{-4}. Relative density of sediment is 2·65 and $\square = 10^{-6}$ m²/s. 6

R^*_c	τ^*_c
15	0·033
25	0·035
35	0·036

4. (*a*) Water flows in a circular conduit 2·80 m diameter set at a slope of 1 in 4000. If the

roughness coefficient n is equal to 0·013 and $Q = 5$ m³/s. Find the normal depth of flow. 6

y/D	□
0·72	0·265
0·62	0·237
0·52	0·215

(*b*) A rectangular channel 3 m wide carries 6 m³/s of flow at a depth of 0·50 m. Calculate the height of a flat topped hump required to be placed at a section to cause critical flow. The energy loss due to the obstruction by the hump can be taken as 0·1 times the upstream velocity head. 4

5. (*a*) A sluice gate in rectangular horizontal channel carrying a discharge of 10 m³/s per metre width at a depth of 2·5 m is partially closed to reduce the discharge by 60 per cent. Calculate the height of the negative surge and velocity of flow after the passage of the wave. 5

(*b*) A wide alluvial channel has a bed material of median size 0·8 mm. The channel has a longitudinal slope of 6×10^{-4}. The depth and velocity in the channel were measured as 1·5 m and 0·8 m/s respectively. Estimate the bed load. 5

6. (*a*) A hydraulic jump occurs in a 90° triangular channel. Derive an equation relating the two depths and the flow rates. If the depths before and after the jump in the above channel are 0·5 m and 1·0 m, determine the flow rate and obtain Froude numbers before and after jump. 7

(*b*) Describe regime of flow. How you will predict regime of flow. 3

7. Design a stable non-erodiable channel to carry 10 m³/s of clear water through a bed 10 mm rounded gravel. A longitudinal slope of 0·0008 and side slope of 2 H : 1 V are to be adopted. 10

8. Write short notes on the following : $2\frac{1}{2} \times 4$

(*i*) Suspended load

(*ii*) Energy dissipators

(*iii*) Specific energy

(*iv*) Abutment scour.
