Question Bank

Unit (I)

1. In what ways is the open channel flow different from the flow in closed conduits ? 5

2 Show that for a given discharge, specific energy is minimum when $Q^2.T / gA^3$ is unity, where T is the water surface width. Obtain expression or the critical depth and minimum specific energy for a wide rectangular 3+2+2=7

3 Obtain the relation between Manning's constant and Chezy's constant. 2

4 Calculate the bottom width of a channel required to carry a discharge of 15 m^3/sec as a critical flow at a depth of 1.2 m, if the channel section is (a) rectangular, and (b) trapezoidal with side slope of 1.5 horizontal : 1 vertical. 3+3=6

5 What is a specific energy curve? Draw specific energy curve, and then derive expressions for critical depth and critical velocity. 1+2+3=6

6 Why is a bed slope provided for an open channel ? 2

7 Classify and characterise the various water surface profiles obtained in a steady gradually varied flow in a prismatic channel under different slopes. 14

8 For a hydraulic jump in a rectangular channel, derive the following relationship. Also state the assumptions involved in the derivation.

9 $y_1y_2(y_1+y_2)=2q_2/g$

10. $E_L=(y_2-y_1)^3/4y_1y_2$ where, E_L is the energy loss, q is the discharge per unit width. 4+4=8

Unit II

1. A rectangular channel carrying a supercritical stream is to be provided with a hydraulic jump type of energy dissipater . If it is desired to have an energy loss of 5.9 m in the jump when the inlet Froude number is 8.5, determine the sequent depth. 6

2. State and discuss the assumptions made in the derivation of the dynamic equation for gradually varied flow. Starting from first principle, derive equation for the slope of the water surface in GVF. Also write down the dynamic equation for wide rectangular channels if (i) Manning's formula is used, and (ii) Chezy's formula is used. 3+7+4=14

3. Discuss the graphical integration method in detail for working out water surface profile in an open channel flow. 14

4. The normal depth of flow of water in a rectangular channel 1.5 m wide is one meter. The bed slope of the channel is 0.0006 and Manning's roughness co-efficient : 0.012. Find the critical depth. At a certain section of the same channel the depth is 0.92 while at a second section the depth is 0.86 m. Find the distance between the two sections. Also find whether the section is located d/s or u/s with respect of the first section. 14

5. Write short notes on any fourof the following : 4x3½=14

(i) Types of open channel flow
(ii) Velocity distribution in open channel flow
(iii) Exponential and non-exponential channels
(iv) Roughness coefficient
(v) Hydraulic gradient
(vi) Hydraulic jump

6. Differentiate between the flows with example :

(i) Laminar and Turbulent flows
(ii) Critical, Sub-critical and Super-critical flow

7. For a wide rectangular channel, derive the relation between

(i) Critical depth and Discharge
(ii) Critical depth and Minimum specific energy

Unit III

Q. 1
(a) What is Darcy-weisbach frication factor?
(b) What is sequent depth ratio?
(c) What is weak jump ?
(di) What is backwater curve?
(e) What is surge in unsteady flow?

3. (a) define boundary layer and derive the expression for displacement thickness, and momentum
(b) a thin rectangular plate 2.25 m long and 12.5 m wide is towed through water ,having $v=1.48*10^{-6}$ m^2/s, at 1.0 m/s velocity. Determine the total drag force on both sides of the plate.
4. (a) what do you mean by critical flow? Derive an expression for critical depth and Froude number for triangular channel.
(b) A rectangular channel is 3.0 m wide and carries a discharge of 15.0 m^3/s at a depth of 2.0 m. At a certain section of the channel, it is proposed to reduce the width to 2.0 m and to alter the bed elevation by Δz to obtain critical flow at contracted section without altering the upstream depth. What should be the value of Δz?
5. (a) explain the cause of channel in transition with a hump in a sub critical flow.
(b) A rectangular channel 3.6 m wide had a widely damaged surfaces and had a Manning's n= 0.03. As a first phase of repair , what is the increase of discharge obtained as a result of repair?

6 (a) sketch the possible GVF profiles in the serial arrangement of channels,if the flow is from left to right : (i) free intake –steep –sluice gate—mild slope,
(ii) mild—sluice gate –steep—horizontal—sudden drop.
(b) A channel has a multiple –roughness types in its perimeter .Assuming that the total discharge in the channel is equal to the sum of the discharges in the partial areas , show that the equivalent roughness is given by

$$N=(PR^{5/3})/_1{}^{n}\Sigma(P_iR_i^{5/3}/n_i)$$

7. (a) Derive the equation for gradually varied flow and write the basic assumptions in analyzing the GVF.
(b) Water flows in 15 m wide rectangular channel at arate 115 m^3 /s . bed Slope is 0.001 and n=0.125. A dam placed downstream raises the height to 6.8 m immediately behind the dam. What is the distance upstream to a point , where depth is 3.7 m? Find by two steps.

Unit 4

1. Derive the equation for sequent –depth ratios and energy loss in exponential channels having $A = K_1 y^a$ in which k_1 and a are characteristic constants.
2. Energy dissipation. If it is desired to have an energy loss of 5 m in the jump when the inlet Froude number is 8.5,determine the sequent depths.
3. define the celerity of a gravity wave and derive its equation for rectangular channel.
4. A 2.5 m wide rectangular channel is carrying a flow depth of 2 m. Determine the height of a surge wave and its velocity if the discharge is suddenly increase to 10 m^3/s at the upstream end.
5. Write short notes on any four of the following :
    a. Economical channel section
    b. Sseparation of boundary laye
    c. What is hydraulics?
    d. What is boundary layer thickness?
    e. What type of flow is (i) breaking of dam, (ii) spreading of irrigation of water on a field?
6. Discuss the graphical integration method in detail for working out water surface profile in an open channel flow. 14

Unit V

Q. 1. Write a short note:

(a) Specific energy curve
(b) Factors affecting mannin's n

Q. 2. Describe the following

(a) Types of hydraulic jump

(b) What is specific energy?
(c) What is critical depth?

3. State and discuss the assumptions made in the derivation of the dynamic equation for gradually varied flow. Starting from first principle, derive equation for the slope of the water surface in GVF. Also write down the dynamic equation for wide rectangular channels if (i) Manning's formula is used, and (ii) Chezy's formula is used. 3+7+4=14

4. Differentiate between the flows with example :
(i) Laminar and Turbulent flows
(ii) Critical, Sub-critical and Super-critical flow