Aryabhatta knowledge university

HYDRAULICS AND OPEN CHANNEL FLOW

Sem. iv 2013 Time 3hr Full marks: 70

Attempt any five question in which question no 1 is compulsory

1. Answer any seven from the following in short in short ,preferably one or two sentences each:

(a) What is hydraulics?

(b) What is boundary layer thickness?

(c) What type of flow is (i) breaking of dam, (ii) spreading of irrigation of water on a field?

(d) What is specific energy?

(e) What is critical depth?

(f) What is Darcy-weisbach frication factor?

(g) What is sequent depth ratio?

(h) What is weak jump ?

(i) What is backwater curve?

(j) What is surge in unsteady flow?

2. (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.

3. (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?

4. (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?

5. (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

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

6. (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.

7. (a) 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.

(b) A rectangular channel carrying a supercritical stream is to be provided with a hydraulic jump type of 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.

8. (a) define the celerity of a gravity wave and derive its equation for rectangular channel.

(b) 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.

9. Write short notes on any four of the following :

(a) Economical channel section

(b) Sseparation of boundary laye

(c) Specific energy curve

(d) Factors affecting mannin's n

(e) Types of hydraulic jump