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ET-533(B)

01404

B.Tech. Civil (Water Resources Engineering)

Term-End Examination

June, 2011

ET-533(B) : OPEN CHANNEL FLOW

Time : 3 hours *Maximum Marks : 70*

Note : *Answer **any five** questions. Neat and labelled sketches should be given in every answer. Use of calculator is permitted.*

1. (a) Explain each with one example : **7**

(i) Steady and uniform flow.

(ii) Steady and Gradually Vaned flow.

(iii) Steady and Rapidly Vaned flow.

(iv) Unsteady and Non-uniform flow.

(b) Show that for a wide rectangular channel the critical depth is given by **7**

$Y_C = \left(q^2/g\right)^{1/3}$, where q is the discharge per unit width of the channel. Also prove that critical depth is equal to one and a half times minimum specific energy.

2. (a) Find the diameter of a circular sewer pipe which is laid at a slope of 1 in 8000 and carries a discharge of 800 litres/sec when flowing half full. Take the value of manning's n = 0.020 7

(b) A rectangular channel 2.5 m wide carries 6.0 m^3/sec 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. 7

3. (a) In a rectangular channel of 0.5 m width, a hydraulic jump occurs at a point where the depth of water flow is 0.15 m. The Froude number is 2.5, determine. 7
   (i) The specific energy
   (ii) The critical and subsequent - depth
   (iii) Loss of head
   (iv) Energy dissipated

(b) State and discuss the assumptions made in the derivation of the dynamic equation for gradually varied flow (GVF). Starting from first principle derive the equation for the slope of the water surface in GVF. 7

4. (a) Sketch the possible GVF profiles in the following serial arrangement of channels and controls. The flow is from left to right. 7
   (i) Steep – horizontal – mild slope
   (ii) Steep – mild – sluice gate – mild – sudden drop.

(b) Using the basic differential equation of G.V.F, show that $\frac{dy}{dx}$ is positive for S_1, M_3 and S_3 profiles. 7

5. (a) Explain the stepwise procedure for computation of GVF by Direct step method. Show the necessary figures and table required for the computation. 10

(b) Derive the relationship between Manning's and Chezy's constants. 4

6. (a) Discuss the conditions which may lead to the formation of surge waves in open channel. 6

(b) A rectangular channel carries a flow with a velocity of 0.65 m/sec and depth of 1.40 m. If the discharge is abruptly increased three fold by a sudden lifting of a gate on the upstream, estimate the velocity and height of the resulting surge. 8

7. (a) Describe the significance of the factors that guide engineers in evaluating the wave forces on structures. 7

(b) Explain how the phenomena of hydraulic jump formation and travel of a translatory wave in an open channel are inter-related. 7

8. Write short notes on ***any four*** of the following :

(a) Velocity distribution in open channel flow
(b) Water surface slopes under different slopes
(c) Celerity of a gravity wave
(d) Method of characteristics
(e) Types of open channel flow
(f) Back water curve **4x3½=14**
