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ET-533(B)

B.Tech. Civil (Water Resources Engineering)

00299

Term-End Examination

December, 2010

ET-533(B) : OPEN CHANNEL FLOW

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any five questions. Neat and labelled sketches should be given wherever necessary. Use of calculator is permitted.*

1. (a) Differentiate between open channel flow and flow in closed conduits. 7

   (b) A triangular gutter whose sides include an angle of 60° conveys water at a uniform depth of 250mm. If the discharge is 0.04 m^3/s, determine the gradient of the trough. Use the Chezy's formula assuming C=52. 7

2. (a) Write a short note on 2x3½=7

   (i) Velocity distribution in a channel section.

   (ii) Pressure distribution in a channel section.

   (b) Calculate the bottom width of a channel required to carry a discharge of $15m^3/sec$ as a critical flow at a depth of 1.2m, if the channel section is (i) rectangular and (ii) trapezoidal with side slope of 1.5 horizontal : 1 vertical. 2x3½=7

3. (a) What is a specific energy curve ? Draw specific energy curve and derive expression for critical depth and critical velocity. **1+2+4=7**

(b) Water flows at a velocity of 1 m/s and a depth of 2m in an open channel of rectangular cross section 3m wide. At a certain section the width is reduced to 1.8m and the bed is raised by 0.65m. Will the upstream depth be affected ? If so, to what extent. 7

4. (a) A spillway discharges a flood flow at a rate of 7.75 m^3/s per meter width. At the down stream horizontal apron the depth of flow was found to be 0.50m. What tail water depth is needed to form a hydraulic jump ? If a jump is formed, find its 7

(i) type
(ii) length
(iii) head loss
(iv) energy loss as a percentage of the initial energy.

(b) Explain the distinction between uniform and non-uniform flow. Show that in an open channel of constant width the slope of the water surface with respect to the bed is given by. 7

$$\frac{dy}{dx} = \frac{S_o - S_f}{1 - \left(\frac{V^2}{gy}\right)}$$

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

6. A river 100m wide and 3.0m deep has an average bed slope of 0.0005. Estimate the length of the GVF profile produced by a low wave which raises the water surface just upstream of it by 1.5m. Use direct step method with intervals of 0.25. Assume n = 0.035. **14**

7. (a) Discuss the conditions which may lead to the formation of surge wave in open channels. **7**

   (b) Design the two transition for a canal waterway that is to cross a natural drainage. Assume the following specifications : **7**

   (i) Discharge in the canal = 25 cumec

   (ii) Bed width of the canal = 20 m

   (iii) Depth of water in the canal = 1.5m

   (iv) Bed width of the flume = 10.0m.

8. Write short notes on ***any four*** of the following **14**

   (a) Method of characteristics

   (b) Dam Break problem

   (c) Factors affecting Manning's "n"

   (d) Celerity of a gravity wave

   (e) Energy dissipators.

   (f) Wave action on Dams.
