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ET-533(B)

00623

B.Tech. Civil (Water Resources Engineering)

Term-End Examination

December, 2012

ET-533(B) : OPEN CHANNEL FLOW

Time : 3 Hours *Maximum Marks : 70*

Note : *Attempt **any five** questions. All questions carry **equal** marks as indicated. Use of calculator is permitted. Assume appropriate data if not given.*

1. (a) State whether the following flows are steady or unsteady and uniform or non-uniform. Also give reasons for your answers. 3x2=6

(i) River flow around a bridge pier

(ii) Flow in a long prismastic canal.

(iii) Movement of water around a boat in a lake.

(b) A trapozoidal channel is to have a longitudual slope of 1 in 1000 and is to be lived with brick work. It has to carry a discharge of $20m^3/sec$ and the slope stability requires the side slopes to be limited to an angle of 30^0. What should be the bed width for the most efficient section ? 6

(c) For a short laboratory flume, the effect of end conditions causes the flow to be non-uniform. What measures are to be taken to achieve a nearly uniform flow? 2

2. (a) A discharge of 16.0 cumec flows with a depth of 2.0m in a rectangular channel 4.0m wide. At a down stream section the width is reduced to 3.5m and the channel bed is raised by Δz. Analyse the water surface elevations in the transitions when Δz =0.35 7

(b) Show that for a horizontal fractionless less channel the minimum specific force for a specified discharge is obtained at a critical depth. 7

3. (a) State and discuss the assumption made in the derivation of the dynamic equation for gradually varied flow. Starting from the first principle derive equation for the slope of the water surface in gradually varied flow with respect to channel bed. **6+2=8**

(b) Using the basic differential equation of G.V.F, show that dy/dx is negative for S_2, M_2 and A_2 profiles. **3x2=6**

4. (a) Explain the stepwise procedure for computing of gradually varied flow by Bakhmeteff method. Construct the table required for the computation. **7+1=8**

(b) A rectangular channel 7.5m wide has a uniform depth of 2.0m and has a bad slope of 1 in 3000. If due to weir constructed at the down stream end of the channel, water surface at a section is raised by 0.75m, determine the water surface slope with respect to horizontal at this section. Assume Manning's n=0.02. 6

5. (a) Discuss the circumstances which may lead to the formation of surge waves in open channel. 7

(b) A tidal estuary is flowing at the rate of 1.8m/sec and a depth of 2m. Owing to the tide in the sea, the level rapidly rose and the resulting surge or bore took over hour to reach spot 19.8km up the stream. Compute the height of the bore above the initial depth of flow. What speed and direction will the flow have after the bore has passed ? 5+2=7

6. (a) A spillway discharge a flood flow at a rate of $7.75m^3/sec$ 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 (i) Type (ii) length (iii) head loss and energy loss as a percentage of the initial energy. 3x2=6

(b) Discuss energy dissipaters in a stilling basin. 8

7. (a) Discuss wave celerity, length and period relationships with reference to wave propagation in an open channel. 7

(b) Discuss the forces that guide engineers in evaluating the wave force on structures. 7

8. Write short notes on ***any four*** of the following : **4x3½=14**

(a) Hydraulic jump

(b) Water surface profile

(c) Dam break problem

(d) Momentum principle

(e) Wave spectrum

(f) Surges and their classification

(g) Morison's equation and their significance

(h) Wave force on structures.