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ET-533(B)

B.Tech. Civil (Water Resources Engineering)

Term-End Examination

00255

December, 2014

ET-533(B) : OPEN CHANNEL FLOW

Time : 3 hours *Maximum Marks : 70*

Note : *Answer any* ***five*** *questions. All questions carry equal marks. Neat and well-labelled sketches are to be given where necessary. Use of calculator is permitted.*

1. (a) Explain the following terms with respect to open channel flow : *3×2=6*

(i) Hydraulic and energy gradients

(ii) Steady and unsteady flow

(iii) Uniform and varied flow

(b) Water flows in a rectangular channel 3·0 m wide at a velocity of 3·0 m/s and at a depth of 3·0 m. There is an upward step of 0·61 m. What expansion in width must take place simultaneously for this flow to be possible as specified ? *8*

2. (a) Explain the applications of specific energy principle to flow situations with a neat sketch. *10*

(b) Explain sequent depths with respect to rectangular sections. *4*

3. (a) Explain the characteristics of various water surface profiles. *8*

(b) Water flows from under a sluice into a trapezoidal channel having a bed width = 6·0 m, side slope of 2 horizontal to 1 vertical, bed slope, S_0 = 0·0036, energy coefficient α = 1·10 and Manning's n = 0·025. The sluice gate is regulated to discharge 11 m^3/s with a depth of 0·2 m at the vena contracta. Determine the behaviour of flow profile at a section where the depth of flow is 0·40 m. *6*

4. (a) Derive the expression for minimum possible energy in subcritical flow with a hump. *10*

(b) A rectangular channel has a width of 2·0 m carrying a discharge of 5 cumecs with a depth of 1·25 m. At a certain section of the channel a small smooth hump, with a flat top and a height of 0·10 m, is proposed to be built. What is the likely change in the water surface, neglecting any loss of energy ? *4*

5. What are Surge waves ? Explain their classification with neat sketches. *14*

6. Water flows from under a sluice into a rectangular channel having a width of 5 m, bed slope of 0·004 and Manning's friction factor of 0·025. The sluice gate is regulated to discharge 50 m^3/s with a depth of 0·025 m at vena contracta. Compute and locate the flow profile. *14*

7. (a) Derive an expression for gradually varied flow equation with the help of a neat sketch. *7*

   (b) A rectangular channel, 6 m wide, carries a discharge of 36·16 m^3/s, with a bed slope, S_0 = 0·0016 and Manning's n = 0·015. Compute the water surface slopes at sections where depth of flow are 2·5 m and 1·8 m, respectively. Assume the following data to be applicable to the channel under consideration :

   The normal depth y_n = 2·00 m

   The critical depth y_c = 1·55 m

   Uniform flow velocity v_n = 3·01 m/s

   cos θ = 1, and velocity coefficient α = 1·0 *7*

8. Write short notes on any ***four*** of the following : $4 \times 3\frac{1}{2} = 14$

(a) Wave spectrum

(b) Wave parameters

(c) First order wave theory

(d) Potential wave energy

(e) Kinetic wave energy