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ET-540(B)

B.Tech. Civil (Construction Management)

Term-End Examination

00820 **June, 2015**

ET-540(B) : FLOW IN OPEN CHANNEL

Time : 3 hours *Maximum Marks : 70*

Note : *Answer any **five** questions. All questions carry equal marks. Give neat and labelled diagram wherever necessary. Use of scientific calculator is allowed.*

1. (a) What is the difference between open channel flow and pipe flow ? 2

(b) In an open channel, clearly show using a neat labelled diagram, the establishment of different flow types. 5

(c) In an open channel, showing the different heads, enumerate the concept of head loss 'h_f'. What difference do you find with pipe flow in similar situations ? 7

2. (a) What is the difference between the steady state and non-steady state flow ? 2

(b) Define Reynolds Number. What are the two types of forces that Reynolds Number is based on ? Give the exact meaning of Characteristic Length in case of open channels. 5

(c) What is the section factor 'Z' of a round cornered rectangular channel for $y > r$? Establish section factor 'Z' from basic principles. 7

3. (a) Define the term 'Specific Energy'. 2

(b) Draw and label the Specific Energy diagram. Prove that the Froude Number

$$F = \frac{v}{\sqrt{gD}}$$

for an open channel. 7

(c) Can the specific energy curve assume a slope > 45° in its subcritical zone ? Give reasons to support your answer. 5

4. (a) In an open channel of 4 m bottom width and 1·2 : 1 side slope of the trapezoidal section and a slope of 0·002 of the channel longitudinally, determine the normal discharge for a normal depth of flow of 3 m. The channel was constructed with brick masonry. 7

(b) Explain the local phenomena in open channel flow. Check whether a well defined and free jump will be formed, if the flow in the channel is 2·5 m^3/s; y_1 = 0·38 m and y_2 = 1·5 m, if the channel width is 2·5 m and cross-section is rectangular using sequent depth concept. 7

5. (a) Define Gradually Varied Flow. *2*

(b) What are the basic assumptions of Gradually Varied Flow ? *5*

(c) Derive the basic equation of G.V.F.

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

from the basic principles. Use a well-labelled diagram. *7*

6. A rectangular channel having the following characteristics is carrying water for irrigation. Compute the water surface slopes. *14*

(i) Channel shape : Rectangular

(ii) Width : 8 m

(iii) Discharge : 40 m^3/s

(iv) Bed slope S_o : 0·0013

(v) Manning's n : 0·017

(vi) Depth of water in I^{st} section : 3·0 m

(vii) Depth of water in II^{nd} section : 1·5 m

(viii) Normal depth (y_n) : 2·0 m

(ix) Critical depth (y_c) : 1·55 m

(x) Cos θ : 1

(xi) Velocity coefficient α : 1·0

7. Water flows from a sluice into a trapezoidal channel having the bottom width of 2 m and side slope of 1 : 5. The bed slope is 0·0015 and the channel is lined with concrete which is 20 years old and worn out. The sluice gate is regulated to discharge 30 m^3/sec with depth 0·20 m at vena contracta. Compute and locate the flow profile. *14*

8. Write short notes on any ***seven*** of the following : *7×2=14*

(a) Sequent Depth

(b) Hydraulic Drop

(c) M2 Profile

(d) G.V.F.

(e) Artificial Control Section

(f) Steady Flow

(g) Normal Depth

(h) Rapidly Varied Flow (R.V.F.)

(i) Froude Number

(j) Laminar Flow