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ET-540(B)

B.Tech. Civil (Construction Management)

Term-End Examination

00052 **December, 2016**

ET-540(B) : FLOW IN OPEN CHANNEL

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **five** questions. All questions carry equal marks. Support your answers with examples and neat diagrams, wherever necessary. Use of scientific calculator is permitted. Assume appropriate data, if not given.*

1. (a) Why is bed slope provided in an open channel ? *3*

(b) A trapezoidal channel 5·0 m wide and having a side slope of 1·5 horizontal : 1 vertical is laid on a slope of 0·00035. The roughness coefficient n = 0·015. Find the normal depth for a discharge of 20 m^3/sec throughout this channel. *7*

(c) For a short laboratory flume, the effect of end conditions causes the flow to be non-uniform. What would you do to achieve a nearly uniform flow ? *4*

2. (a) Show that for a given discharge, specific energy is minimum when Q^2T/gA^3 is unity, where T is the water surface width. Obtain the expression for the critical depth and minimum specific energy for a wide rectangular channel. *3+2+2=7*

(b) Explain, by specific energy head diagram, that for a given value of the specific head there are two possible depths of flow for a given rate of discharge. *5*

(c) Obtain the relation between Manning's constant and Chezy's constant. *2*

3. (a) Show that the Froude numbers F_1 and F_2 in a hydraulic jump occurring in a rectangular channel are related by

(i) $F_2^2 = 8F_1^2 / (-1 + \sqrt{1 + 8F_1^2})^3$

(ii) $F_1^2 = 8F_2^2 / (-1 + \sqrt{1 + 8F_2^2})^3$ *6*

(b) 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. Froude number is 2·5. Determine : *4×2=8*

(i) The specific energy

(ii) The critical and subsequent-depth

(iii) Loss of head

(iv) Energy dissipated

4. (a) Derive the different forms of the Dynamic Equation of gradually varied flow. *5*

(b) A rectangular channel, 4·0 m wide, has a Manning's coefficient of 0·025. For a discharge of 6·0 m^3/sec., identify the possible types of GVF profiles produced in the following break of grades : *3×3=9*

(i) S_{01} = 0·0004 to S_{02} = 0·015

(ii) S_{01} = 0·015 to S_{02} = 0·0004

(iii) S_{01} = 0·005 to S_{02} = 0·0004

5. (a) A river, 100 m wide and 3·0 m deep, has an average bed slope of 0·0005. Estimate the length of the GVF profile produced by a low weir which raises the water surface just upstream of it by 1·50 m. Use Direct Step Method with at least five intervals. Assume n = 0·035. *11*

(b) What is the essential difference between gradually varied flow and rapidly varied flow ? Illustrate with neat sketches. *3*

6. (a) An open channel has the following boundary material :

(i) Fine sand

(ii) Silt

(iii) Coarse sand and gravel

(iv) Boulders

(v) Fine soil with aquatic weed growth

Arrange these in the order of increasing roughness indicating an approximate value of the Manning's roughness n. *5×1=5*

(b) In a wide rectangular channel, if the normal depth is increased by 20%, find the percentage increase in the discharge. Use Manning's equation. 3

(c) Using the basic differential equation of G.V.F., show that dy/dx is negative for M2, A2 and H2 profiles. $3 \times 2 = 6$

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

(a) Pressure Distribution in Open Channel Flow

(b) Uniform Flow

(c) Submerged Jump

(d) Geometric Elements of Open Channel

(e) Water Surface Profiles

(f) Specific Energy Curve
