No. of Printed Pages : 4

ET-540(B)

B.Tech. Civil (Construction Management)

Term-End Examination

June, 2016

00910

ET-540(B) : FLOW IN OPEN CHANNEL

Time : 3 hours *Maximum Marks : 70*

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

1. (a) In what ways is the open channel flow different from the flows in closed conduit ? *3*

(b) Find the bed slope of a trapezoidal channel using Chezy's formula having bed width 4 m, depth of water 3 m and side slope of 2 horizontal to 3 vertical, when the discharge through the channel is 20 m^3/sec. Take Manning's n = 0·03. *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) A 5·0 m wide rectangular channel carries 15·0 m^3/sec discharge at a depth of 1·5 m.

(i) What is the critical depth ?

(ii) What is the specific energy ?

(iii) Is the flow subcritical or supercritical ?

(iv) What is the depth alternate to 1·5 m ? *8*

(b) Show that for a horizontal frictionless channel, the minimum specific force for a specified discharge is obtained at the critical depth. *6*

3. (a) For a hydraulic jump in a rectangular channel, derive the following relationship. Also state the assumptions involved in the derivation.

(i) $Y_1Y_2(Y_1 + Y_2) = 2q^2/g$

(ii) $E_L = \frac{(Y_2 - Y_1)^3}{4Y_1Y_2}$,

where E_L is the energy loss, q is the discharge per unit width and Y_1 and Y_2 are sequent depths. *6+2=8*

(b) A hydraulic jump occurs in a rectangular channel and the depths of flow before and after the jump are 0·5 m and 2·0 m, respectively. Calculate the critical depth and the power lost per unit width of the channel. *3+3=6*

4. (a) 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 *2+6=8*

$$\frac{dy}{dx} = \frac{(S_0 - S_f)}{\left(1 - \left(\frac{v^2}{gy}\right)\right)}.$$

(b) Using the basic differential equation of G.V.F., show that $\frac{dy}{dx}$ is positive for S_1, M_3 and S_3 profiles. *6*

5. (a) Explain the stepwise procedure for computation of G.V.F. by standard step method. *10*

(b) Differentiate between a 'backwater curve' and a 'drawdown curve'. *4*

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

(i) Fine sand

(ii) Silt

(iii) Coarse sand and gravel

(iv) Boulders

(v) Fine soil with aquatic weed growth

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

(b) A rectangular channel with a bottom width of 4·0 m and a bottom slope of 0·0008 has a discharge of 1·5 m^3/sec. In a gradually varied flow in this channel, the depth at a certain location is found to be 0·30 m. Assuming n = 0·016, determine the type of G.V.F. profile. *9*

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

(a) Velocity Distribution in Open Channel Flow

(b) Hydraulic Grade Line and Total Energy Line

(c) Types of Hydraulic Jump

(d) Types of Open Channel Flow

(e) Dimensionless Numbers

(f) Specific Energy Curve
