B.Tech. Civil (Water Resources Engineering)

Term-End Examination

June, 2012

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) A trapezoidal channel ($b = 2$ m ; $z = 1$) **10** carries a uniform flow with $y = 0.32$m. If the discharge is 0.09 cumec, what is the bed slope of the channel ? Take n = 0.015.

    (b) Solve (a) if C = 54. Why there is difference **4** in the value of bed slope compared to one obtained in (a) ? Explain.

2. (a) Derive the dimensions of Manning's **2** Coefficient 'n'.

    (b) Derive the relation between c and n . **2**

    (c) What is the bed width of a channel for **4, 6** carrying $Q = 10.75$ m^3/s at a critical depth of 0.88 m if :

    (i)   The channel section is rectangular.

    (ii) The section is trapezoidal ($z = 1$)

3. (a) A rectangular channel (b=2.60 m) carries a   **10**
         flow at a velocity of 0.98 m/s, and at a depth
         of 1.35 m. If at some location, its width is
         reduced by half, and also its bed is raised
         by 0.40 m, What happens to the upstream
         depth of flow ?

    (b) What do we mean by the *maximum*
         discharge through a channel at :   **2 , 2**

         (i) a given specific energy

         (ii) a given specific force

4. Giving a sketch, derive the governing equation of   **14**
    the water surface profile in a non - uniform flow.
    Explain the sketch.

5. Sketch out any standard USBR energy dissipator   **14**
    placed down - stream of a spillway. Explain the
    function of each element.

6. (a) Draw a cross - section of a spillway used in   **8**
         a gravity dam. Explain how its various
         dimensions are arrived at.

    (b) What is meant by its design head ?   **3**

    (c) What is velocity of a approach in this   **3**
         regard ? How does it affect the design
         head ?

7. A river with an average bed slope of 0.00048, bed **14** width = 110m carries a flow at a depth of 3.5 m. A low dam, across the river, raises the depth of water to 5.0 m, immediately behind itself. Calculate the length of the water surface profile that is developed using suitable length intervals. Take $n = 0.029$.

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

   (a) Design of a transition connecting a canal with an aqueduct that crosses over a river. What data is required for the design ?

   (b) Method of characteristics _____ and its basic use.

   (c) celerity of a gravity wave and its significance.

   (d) Protection of sea - shore against sea waves.

   (e) Explanation of the fact that the value of n does not change whether we work with FPS or MKS units.