B.Tech. Civil (Construction Management)

Term-End Examination

December, 2006

ET-540(B) : FLOW IN OPEN CHANNEL

Time : 3 hours *Maximum Marks : 70*

Note : *Solve any **five** questions. All questions carry equal marks. Use of calculator is permitted.*

1. Explain, with the help of neat and labelled sketches, gradually varied and rapidly varied flow. Give two practical examples (each with a sketch) for each case. *14*

2. (a) Calculate the following quantities : *3, 4, 3*

(i) Area of flow in a parabolic open channel whose top width of flow is 2 m and the depth of flow is 0·5 m. Draw its sketch and state the formula used.

(ii) Hydraulic radius of a trapezoidal channel whose depth of flow is 1·0 m, base width is 2·0 m and side slope 1 : 1. Show these dimensions on a neat diagram. Write the formula used, explaining the symbols.

(iii) Wetted perimeter of a triangular channel whose $z = 2$ and $y = 2$. Sketch out the section and explain the symbols used in the formula.

(b) Explain what is meant by section factor, and hydraulic depth of an open channel. *4*

3. Draw a neat dimensionless (not to scale) illustrative diagram that is used for determining y_n of a channel when section factor is given. Explain its use for various channel shapes. *14*

4. (a) In a horizontal rectangular channel 1·35 m wide, determine if a well-defined and free jump will be formed (under proper conditions) if the flow in the channel is 0·2 m^3/s, y_1 = 0·02 m, and y_2 = 0·41 m. Also find the required sequent depth. Comment on the difference between the given y_2 and the required depth. *9*

(b) Prove that in a free jump on a horizontal bed,

$$\Delta E = (y_2 - y_1)^3 / 4y_1y_2$$

where, the symbols carry the usual meaning. *5*

5. Derive, making necessary assumptions, the dynamic equation of a gradually varied flow giving an explanatory sketch (neat and labelled) and the meaning of the symbols used. *14*

6. Describe the theory and computational procedure (with necessary table to be filled) for working out water surface profile in an open channel by *graphical integration* method. Give the necessary diagrams. *14*

7. Describe (giving theoretical background) the *Standard Step method* of water surface profile in an open channel. Show how you will work out the results to fill the required table. Under what circumstances is this method very suitable ? *14*

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

(a) Reynolds number

(b) Prismatic channel

(c) Energy loss in a jump

(d) Hydraulic jump

(e) Uniform flow

(f) Hydraulic gradient