

**B.Tech. Civil (Water Resources
Engineering)****Term-End Examination****June, 2008****ET-533(B) : OPEN CHANNEL FLOW**

Time : 3 hours

Maximum Marks : 70

Note : Solve any **five** questions. All questions carry equal marks. Give neat and labelled sketches in support of your answer. Use of calculator is allowed.

1. (a) For a trapezoidal channel with bottom width 40 m and side slopes 2 H : 1 V, Manning's n is 0.015 and bottom slope is 0.0002. If it carries $60 \text{ m}^3/\text{sec}$ discharge, determine the normal depth. 5
- (b) Find the diameter of a circular sewer pipe which is laid at a slope of 1 in 8000 and carries a discharge of 800 litre/sec when flowing half full.
Take $n = 0.02$. 5
- (c) Explain the terms : 4
- (i) Channel conveyance
 - (ii) Section factor
 - (iii) Hydraulic mean depth
 - (iv) Uniform flow

2. (a) Design the two transitions for a canal waterway that is to cross a natural drainage. The following specifications are available. Discharge in the canal is 25 cumecs, bed width of the canal is 20 m, depth of water in the canal is 1.5 m and bed width of the flume is 10 m. 7
- (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. 4
- (c) What is the essential difference between gradually varied flow and rapidly varied flow? Illustrate with neatly drawn sketches. 3
3. (a) An overflow spillway is 40.0 m high. At the design energy head of 2.5 m over the spillway find the sequent depth and energy loss in a hydraulic jump on a horizontal apron at the toe of the spillway. Neglect energy loss due to flow over the spillway face. Assume $c_d = 0.738$. 8
- (b) Derive different forms of the dynamic equation of gradually varied flow. 6
4. (a) Explain the stepwise procedure for computing of gradually varied flow by direct step method. Show the necessary figures and tables required for the computations. 9

- (b) A rectangular channel with a bottom width of 4.0 m and a bottom slope of 0.0008 has a discharge of $1.5 \text{ m}^3/\text{sec}$. 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 GVF profile. 5
5. (a) Discuss the circumstances which may lead to the formation of surge waves in open channel. 6
- (b) A rectangular channel carries a flow with a velocity of 0.65 m/sec and depth of 1.40 m. If the discharge is abruptly increased threefold by a sudden lifting of a gate on the upstream, estimate the velocity and height of the resulting surge. 8
6. (a) Discuss wave celerity, length and period relationships with reference to wave propagation in an open channel. 7
- (b) Explain how the phenomena of hydraulic jump formation and travel of a translatory wave in an open channel are inter-related. 7
7. Write short notes on any **four** of the following : $3\frac{1}{2} \times 4 = 14$
- (i) Method of characteristics
 - (ii) Dam break problem
 - (iii) Morrison's equation and its significance
 - (iv) Roughness coefficient
 - (v) Celerity of a gravity wave
 - (vi) Practical application of standing surge
 - (vii) Hydraulic jump
 - (viii) Velocity distribution in open channel flow

