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16217(D) - 0 DEC 2016

B. Tech 7th Semester Examination

Open Channel Flow (NS)

CE-411(C)

Time : 3 Hours **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt five questions in all, selecting one question from each sections A, B, C and D. Section E is compulsory.

SECTION - A

1. (a) Describe the various types of open channels. (8)

   (b) A small stream has a surface width of 20 m. At a section the discharge is measured as 30 cubic meter/s and water surface at this section is rising at the rate of 0.12 m/h. Estimate the discharge at a section which is 1.5 km on upstream side. (12)

2. (a) Explain energy and momentum correction factors in open channel flow. (8)

   (b) The velocity in a wide rectangular channel may be approximated by the equation v=0.4+0.6y/h m/s. Calculate average Velocity, Energy correction factor and Momentum correction factor if h = 1.0 m. (12)

SECTION - B

3. (a) Derive expressions for hydraulically efficient trapezoidal section for a channel. (10)

   (b) A hydraulically most efficient rectangular channel section is to be designed to carry a discharge of 5 cubic meter per second. Assume Manning's n=0.015. (10)

4. Discuss Manning's and Chezy's equations for uniform flow in a channel, describing various terms and coefficients used in these equations for a rectangular section and a trapezoidal channel sections. Calculate discharge through a trapezoidal channel of bed width 6 m and side slope of 1 horizontal to 3 vertical, when depth of flow of water is 3 m and Chezy's constant C=60. The bed slope is given as 1 in 5000. (20)

SECTION - C

5. What is a Gradually Varied Flow in open channel? Derive differential equation of Gradually Varied Flow. Using this equation show that dy/dx is positive for S1, M1 and S3 profiles. (20)

6 Determine the length of back water curve caused by an afflux of 2.0 m in a 40 m wide and 2.5 m deep rectangular channel, having a bed slope of 1 in 11000. Assume Manning's N= 0.03 (20)

SECTION - D

7. Derive expressions for sequent depth ratio and energy loss in a hydraulic jump in a Horizontal Rectangular Channel. (20)

8. An overflow spillway has its crest at an elevation of 125.4 m and a horizontal apron at an elevation of 95.0 m on the downstream side. Find the tail water elevation required to form a hydraulic jump when the upstream energy line is at elevation 127.9 m. The coefficient of discharge can be assumed as 0.735. The energy loss for the flow over spillway face can be neglected. (20)

[P.T.O.]

SECTION - E

9. Answer the following questions:

(a) Explain steady uniform flow in an open channel.

(b) Define specific energy.

(c) Define Critical depth.

(d) Describe Type-M water surface profiles for gradually varied flow.

(e) Explain the term length of hydraulic jump.

(f) On the downstream of spillway how you can check that hydraulic jump occurs?

(g) Give examples of spatially varied flows.

(h) How will you estimate Froude number and decide about the flow to be critical, subcritical or super critical in a rectangular channel?

(i) For a given discharge per unit width, how does the specific energy varies for various depth of flows in a channel?

(j) Define Mild and Steep slopes in open channels.

(10×2=20)