Seat No. | | | | | | |

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मजल - 071

ELECTIVE - I

Open Channel & Conduit Flow

(Old) (1045)

P. Pages : 4

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

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answersheet should be written with blue ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Answer **any one** question from each of five units.
5. Each question carries **20** marks.
6. Figures to right indicates full marks.
7. Assume suitable data if necessary.
8. Use of non-programmable calculator is allowed.

UNIT - I

1. a) An Open channel of most economical section having the form of half hexagon with horizontal bottom is required to give a maximum discharge 20.2 m^3/sec of water. The slope of channel bottom is 1 in 2500. Taking C = 66 $m^{1/2}$ in Chezy's equation, determine the dimensions of c/s. Take value of velocity of flow in channel as obtained by Chezy's equation, determine value of 'n' in Manning's formula. **10**

b) A discharge of 16 m^3/s flow with a depth of 2m in a rectangular channel 4m wide. At a downstream section the width is reduced to 3.5m and a channel bed is raised by ΔZ. Analyse the water surface elevation in the transition when $\Delta Z = 0.2$ m. **10**

2. a) A 3.6 m wide rectangular channel carries water at a depth 1.8m. In order to measure a discharge in channel, width is reduced to 2.4m and hump of 0.3m is provided in bottom. Calculate the discharge if the water surface in contracted section drops by 0.15m. Assume there is no losses. **10**

b) A trapezoidal channel with side slope 2H : 1V has to be designed to carry 15 m^3/sec at a bed slope of 1 in 5000. Determine the dimensions of the efficient section. Assume Manning's n = 0.014. **10**

UNIT - II

3. a) What is meant by GVF ? What are the assumptions involved in analysis of GVF? Derive the basic differential equation of GVF in an open channel. **10**

b) The normal depth of flow of water in rectangular channel 1.5m wide is 1.0m. The bed slope of channel is 0.0006 and Manning's roughness coefficient n = 0.012. Find the critical depth.
At certain section of the same channel the depth is 0.92 m while at a section the depth is 0.86 m. Find the distance between the sections (use one reach in the calculations). Also find whether the section is located downstream or upstream with respect to first section. **10**

4. A small stream has cross section which can be approximated by a trapezoid The cross sectional properties at three sections are as follows.

Section	Distance up the river (km)	Bed elevation (m)	Bed width (m)	side slop
A	100.00	100.00	14.0	1.5:1
B	102.00	100.80	12.5	1.5:1
C	103.50	101.40	10.0	1.5:1

Section A is the downstream most section. For a discharge of 100 m^3/s in the stream, water surface elevation at A was 104.500 m. Estimate the water surface elevation at upstream section B & C. Assume η = 0.02 and $\alpha = 1.0$ at all sections. **20**

UNIT - III

5. a) A sluice gate discharge 2 m^3/s in to a wide horizontal rectangular channel the depth at veena contracta is 0.15 m. The tail water depth is 1.8 m. Assume the channel to have a Manning's n = 0.015, Determine the location of hydraulic jump. **10**

b) A horizontal rectangular channel of 3m width and 2m depth convey water at 18 m^3/sec. If the flow rate is suddenly reduced to 2/3 of its original value, compute the magnitude and speed of upstream surge.
Assume that the front of surge is rectangular and friction in channel is neglected. **10**

6. a) Give the classification of hydraulic jumps ? Also derive the equation of energy loss in hydraulic jump formed in rectangular horizontal frictionless channel. **10**

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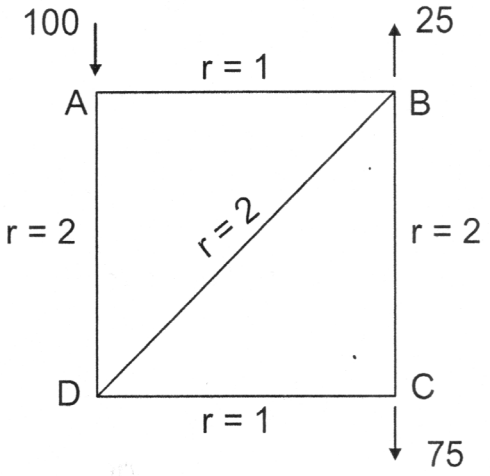
b) A tidal estuary is floating at rate of 6.5 km/hr and a depth of 2m. Owing to a tide in a sea the level rapidly rose and resulting surge or 'bore' took one hour to reach to a spot 22.5 km up the stream compute the height of bore above the initial depth of flow. What speed and direction will the flow have after the bore has passed ? **10**

UNIT - IV

7. a) A water tank discharges to atmosphere through a 100 m long 20 cm diameter pipe branching into 60 m long 10 cm diameter and 120 m long 10 cm diameter pipe. The elevation above datum of outlets are 100.00 m for 120 m branch and 105.00 m for 60 m branch. The water surface in the tank is at an elevation of 125.00 m. Assume f = 0.02 for all pipes. Estimate the discharge in the two outlets. **10**

b) Calculate the discharge in distribution network shown in figure. by $h_f = r \cdot Q^{1.85}$ The values of r for various pipes and also the inflow and outflow at nodes are shown. To start the calculation following trial discharges are suggested.

Line	AB	BD	AD
Discharge Q units	56	03	44
Direction	A to B	B to D	A to D



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8. Estimate the economical diameter of raw water rising main of a water supply system for a village using following data :
Design population - 7000
Rate of water supply - 60 lpcd
Floating population - 4%
Pumping hrs - 06 hrs/day
Loss in system - 15%
Static head = 20 m
Length of rising main = 3 kms
Design period - 20 years **20**

UNIT- V

9. a) What is meant by surge tank ? Where and why it is provided ? Explain any two types of surge tanks. **10**

b) A steel pipe 30 cm diameter and has a wall thickness of 3 mm, 1000 m long conveys a flow of 100 lit/sec of oil relative density 0.82. The static heat at outlet is 160 m of oil. If working stress of steel is 0.1 kN/mm^2. Calculate the minimum time of closure of downstream valve. For oil $k = 1 \times 10^8$ Pa for steel $E = 2.14 \times 10^{11}$ Pa. **10**

10. a) A 15 cm diameter, 1500 m long pipe leads from large reservoir to an outlet which is 20 m below the water level in the reservoir. If a valve at pipe outlet is suddenly opened estimate the time required to reach
i) 50% ii) 95% of steady state discharge.
Assume f = 0.02 and minor loss as $k_1 \cdot \frac{v^2}{2g}$ with $k_1 = 5.00$. **10**

b) A simple cylindrical surge tank 6.0 m diameter, is provided on a penstock of 2.5 m dia at a distance of 3 km from reservoir. If the discharge in penstock is 11.5 m^3/sec. Calculate the maximum up surge and time required to attain it due to complete and sudden closure of d/s valve. Assume f = 0.02 Also find the minimum required height of surge tank above the static reservoir level. **10**

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