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ELECTIVE - I
Open Channel & Conduit Flow
(New) (1251)

P. Pages : 4

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

Instructions to Candidates :
1. Do not write anything on question paper except Seat No.
2. Answer sheet 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 two** questions from each of five units.
5. Each question carry 10 marks.
6. It is advised to solve all parts of a question in one stretch.
7. Figures to the right indicate full marks.
8. Assume suitable data, if necessary.

UNIT – I

1. a) A circular channel, laid on a slope of 1 in 400, having diameter 2m, carries a discharge of 2 m^3/s. Manning's n = 0.012. Find the normal and critical depths of flow. Following table for circular channel may be used. **10**

Y / D	$Z / D^{2.5}$	$AR^{2/3} / D^{8/3}$
0.33	0.11081	0.07330
0.34	0.11739	0.07758

b) Show that for a hydraulically efficient triangular channel section, the hydraulic radius is given by $R = Y/Z\sqrt{2}$. A triangular channel carries 8 m^3/s of water when laid on a bed slope of 1 in 20001 having Manning's n = 0.018. Determine the dimensions of most efficient triangular section. **10**

c) A rectangular channel carries a flow of $3\ m^3/s$ per meter width at a depth of 1.5m. Calculate the minimum rise in the flow at a section required to produce critical flow conditions. Also calculate the corresponding fall in the water level. **10**

UNIT – II

2. a) Define GVF. Describe with neat sketches the possible GVF profiles in a steep sloped channel. Give one practical example of each type. **10**

b) Describe standard step method for computing. GVF profiles in open channel flow. State the equations used and explain the procedure with the help of table. **10**

c) For a discharge intensity of 2.5 $m^3/s/m$ in a wide rectangular channel, having Manning's n = 0.02, identify the possible types of GVF profiles produced when the bed slopes changes from 0.0005 to 0.005. Sketch the L-section of channel and the GVF profiles. **10**

UNIT – III

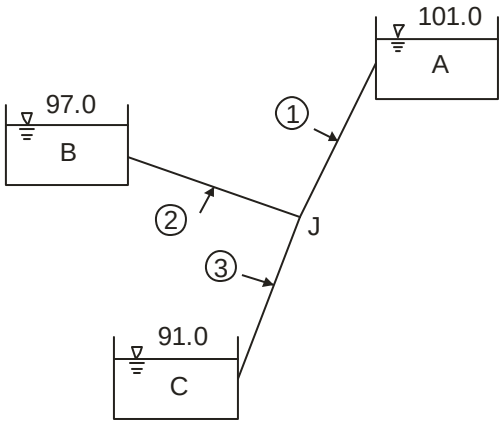
3. a) Starting from the basic principles derive the equation for energy loss in a hydraulic jumped formed in horizontal, rectangular. frictionless channel. **10**

b) An over flow spillway is 35m high. If the total head of water including head due to velocity of approach is 1.5m above the spillway crest, find the sequent depths and energy loss in a hydraulic jump formed on a horizontal rectangular apron on downstream side, at the toe of the spillway. Neglect energy loss due to flow over the spillway surface. Assume $C_d = 0.70$. **10**

c) A tidal estuary carries water at 3.6 km/hr with a depth of 1.5m. Due to tides in sea, the sea level raised rapidly and the resulting bore took one hour to reach a spot 18 km up stream. Calculate the height of the bore. Also find the speed and direction of flow in the estuary after the passage of the bore. **10**

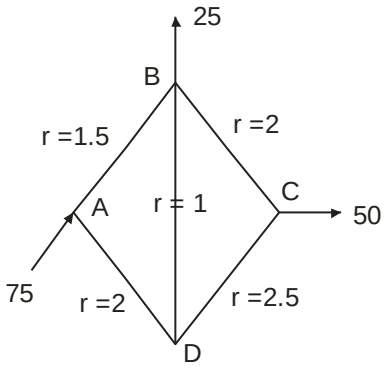
UNIT – IV

4. a) For a three reservior problem shown in the figure, calculate the discharge in each pipe and the piezometric head at J. Neglect minor losses and frictional loss in m of water, for each pipe is $h_f = r Q^{i.90}$ where Q is discharge in m^3/s. Take two trial only. Assume $r_1 = 135, r_2 = 68, r_3 = 130$ **10**



b) Describe the step wise procedure for calculating the economical diameter of raw water rising main of a water supply system for a town. **10**

c) Determine the distribution of discharge in the pipe network as shown in figure the head loss for each pipe is given by $h_f = r\, Q^{1.95}$. Take two trials only. **10**



UNIT – V

5. a) Explain gradual and rapid closure of valve with respect to water hammer phenomenon in pipe flow. Derive expression for water hammer pressure rise in an elastic pipe due to rapid and complete closure of valve at the down stream end of pipe. **10**

b) A steel pipe, 1 km long, 30 cm diameter, having wall thickness 2.5mm carries oil of Sp.gr. 0.80 at a rate of 100 l/s. The static head at the outlet is 165 m of oil. If allowable working stress of steel is 0.1 kN/mm^2. Calculate the minimum time of closure of down stream valve. For oil , assume k = 16 Pa & for steel, E = 2106 Pa. **10**

c) A power plant develops 8 MW power under a head of 100m at overall efficiency of 75%. A pen stock, 2.4 m diameter, supplies water to the plant from a reservoir having water surface elevation of 100m. At a distance of 2.2 km from reservoir, a simple cylindrical surge tank of diameter 8 m is provided in penstock. Assuming sudden & complete closure of turbine valve, find the required top elevation of the surge tank. Also find time required to attain the maximum upsurge in the surge tank, after closure of the valve. Consider frictional effects & assume f = 0.020 for the pen stock. **10**

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