B.E. Eighth Semester (Civil Engineering) (C.B.S.)

Elective - II : Water Transmission & Distribution System

P. Pages : 4 **KNT/KW/16/7535**

Time : Three Hours * 0 3 2 0 * Max. Marks : 80

Notes :
1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.
8. Assume suitable data whenever necessary.
9. Illustrate your answers whenever necessary with the help of neat sketches.
10. Use of non programmable calculator is permitted.

1. A multi reservoir system consists of four reservoirs A(HGL = 100.0m), B(90.0m), C(HGL=80.0m) and D(HGL = 60.0m) are connected by a pipe system as given below with two junctions J_1 and J_2. The details of pipes as per their connectivity are given below. **14**

Pipe	Length (m)	Dia (mm)	f
AJ_1	400	300	0.022
J_1B	380	250	0.022
J_1J_2	390	250	0.022
J_2C	310	150	0.022
J_2D	440	200	0.022

Determine the discharges and their directions in each pipe and also HGL values at the junctions.

OR

2. A pump 'P' lifts water from a sump (WL = 100.0 m) to two reservoirs A (WL = 128.0 m) and B(WL = 117.0 m) Both the reservoirs are connected with a common junction J through pipe JA and JB and the junction is also connected with the pump 'P' The pipe details are **14**

Pipe	Length (m)	Dia (mm)	f
PJ	350	300	0.03
JA	300	250	0.03
JB	350	200	0.03

The pump characteristics is $H = 60 - 450Q^2$ in which H is head developed by the pump in 'M' and Q is discharge in m^3/sec. Neglect the suction pipe length, determine discharge supplied to the reservoirs and also HGL value at the junction.

3. The network has two source nodes A and D with the constant HGL values of 100.0 m and 92.0 m respectively. It has three demand nodes B, C and D with the demands 0.3, 0.4 and 0.25 m^3/sec respectively. The pipe resistant constant for pipes in head loss formula $h_f = rQ^{1.85}$ are pipe AB, r = 20, pipe AC, r = 25, pipe BD, r = 18, pipe CD, r = 22, pipe CE, r = 30 and pipe DE, r = 22. Carryout ONE iteration of analysis by Hardy cross method of balancing flow. **13**

OR

4. The network as described in Q. No. 3 is to be analysed by Newton Raphson method by using H equation carryout ONE iteration. **13**

5. A serial network as shown in fig. 1 has a source node A with a constant HGL value of 100.0 m and four demand nodes B, C and D and E with the minimum HGL values 92.0 m, 90.0 m, 91.0 m and 87.0 m respectively. The pipe resistance constant in head loss formula $h_f = rQ^{1.85}$ (h_f is in 'm' and Q is in m^3/sec) are given along the pipes. The nodal discharge in m^3/sec are given near the arrow heads carryout node flow analysis of the network. **13**

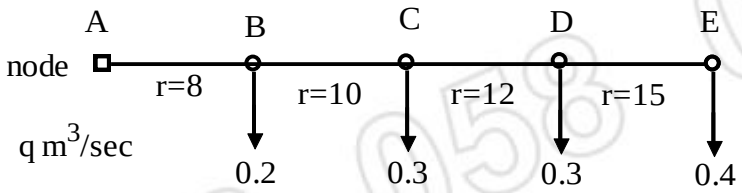

Fig. 1

OR

6. a) Explain node flow analysis. State whether it is giving an optimal analysis of the water distribution network. **6**

b) What do you mean by node flow compatibility ? How node categories are converted if it is not obtained at a node. **7**

7. a) What do you mean by branching of a network ? Why is it needed and how a loop network is converted in a branch network. **6**

b) Differentiate path concept method and minimum spanning of route method. **5**

c) What is a first trial HGL values, how are they selected. **3**

OR

8. For the network as shown in fig. 2, prepare node to node incidence matrix and determine the number of possible trees by using graph theory. Also sketch the trees in which links 2 and 3 are present always. **14**

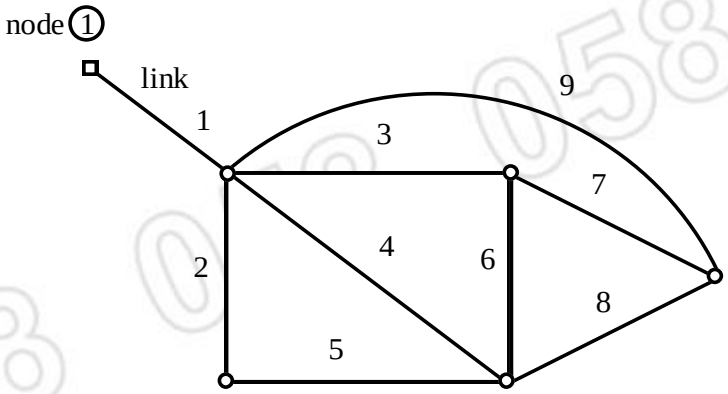

Fig. 2

9. In the network as shown fig. 3 node '0' is a source node with a constant HGL value of 100.0m and nodes 1, 2 and 3 are demand nodes with the minimum HGL values of 91.0 m, 89.0 m and 87.0 m respectively. The demand in m^3/sec in these nodes respectively as 0.3, 0.35 and 0.45, The pipe lengths are given in the fig. The C_{HW} in Hazen William head loss formula is 100 for all the pipes. The cost function is $C = 0.138 D^{1.42}$ in which C is cost per m length in Rs and D is pipe dia in mm. **13**

Carryout ONE iteration of optimisation by using cost head loss ratio criterion.

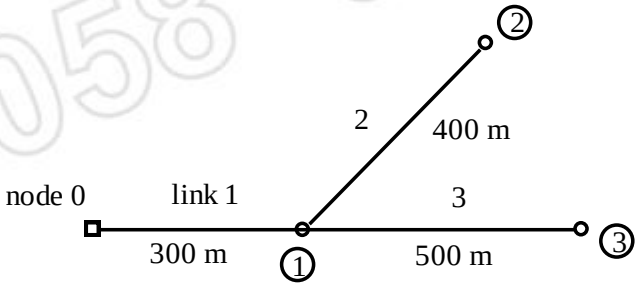

Fig. 3

OR

10. The network described in Q. No. 9 is to be optimized by linear programming technique. The available pipe sizes are : **13**

80, 100, 120, 150, 180, 200, 250, 300, 350, 400, 450, 500, 550, 600, 700, 800 mm.

Use the same cost function for these sizes frame LP modal and obtain the basic feasible solution. Also write the steps how linear programming is carried out and how the optimal cost will be obtained or judged.

11. A rising main has to lift 5 million litres of water per day to serve a town of population 200000. The static lift is 30.0 m and pumping is to be done in two equal instalments of 8 hour each. The length of the main is 1.5 km The overall efficiency of the pump is 75% The cost of electricity is Rs 2.80 per kwh and the scheme is planned for next 30 years. The rate of interest is 8% and OMR charges are 7% of the initial capital cost. The available pipe sizes are given below select the optimal dia of the pumping main **13**

Pipe Size (mm)	Unit Cost (Rs.)	C_{HW}
350	6000	100
550	8500	102
700	12500	103

12. The following data corresponds to a distribution reservoir - **13**

Time Interval (hrs)	Demand (m^3/min)
0 - 2	2.1
2 - 3	4.8
3 - 6	15.2
6 - 8	6.4
8 - 9	4.8
9 - 12	25.7
12 - 14	17.4
14 - 16	8.8
16 - 18	10.2
18 - 21	18.0
21 - 24	8.3

The pumping is to be done at a uniform rate from 6 to 12 hrs and 18 to 24 hrs.
Determine :

i) The reservoir capacity.

ii) Time (s) when reservoir is full and time (s) when reservoir is empty.

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