Answer all the following Questions (assume any missing data)

Marks

Question (1)
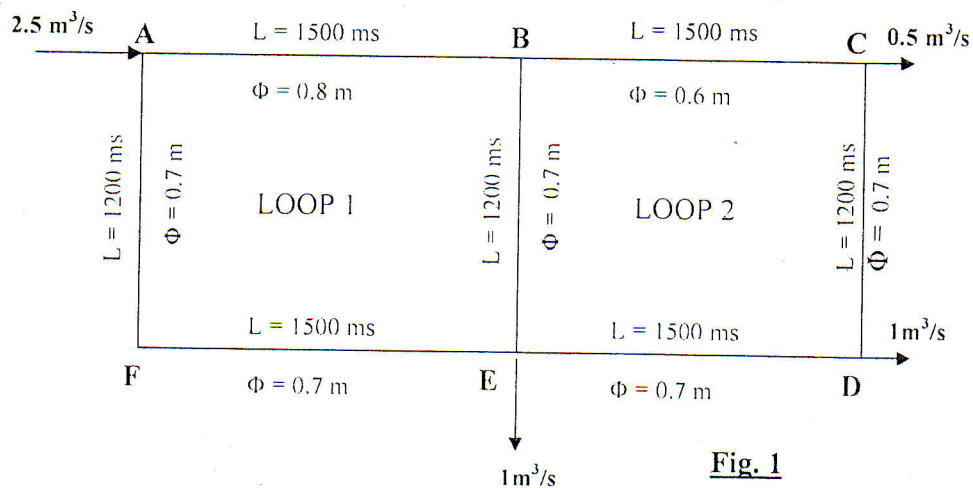
[20]

Discuss the different types of pipes used in water distribution networks and sewerage systems provide advantages and disadvantages for each ………………………........... *(20)*

Question (2)

[30]

Given the network shown in Fig. 1, the inflow at A, and outflows at C, D and E. Using Hardy Cross method, find the flows in the individual pipes comprising the network (only one trial is required)… …. … … … … … … … … … … … … *(30)*

Fig. 1

Question (3)

[30]

(a) Mention five different methods for prediction of future population …………............ *(5)*

(b) The following table shows the population in millions of a country during the years 1950 – 2010, in ten years intervals. … … … … … … … … … … … … … … … … … …. … … … *(25)*

Year	1950	1960	1970	1980	1990	2000	2010
Population (million)	23.2	31.4	39.8	50.2	62.9	76	92

1) Find the equation of the least square parabola fitting the data.

2) Estimate the population in 2030 & 2050

Knowing that :

$$\Sigma Y = aN + b\Sigma X + c\Sigma X^2$$
$$\Sigma XY = a\Sigma X + b\Sigma X^2 + c\Sigma X^3$$
$$\Sigma X^2 Y = a\Sigma X^2 + b\Sigma X^3 + c\Sigma X^4$$

Question (4)

[20]

a) Draw Oxygen Sag Curve showing all components and parameters. .... (10)

b) Wastewater discharges to a river resulting initial BOD = 12.0 mg/L and DO = 7.0 mg/L.
Calculate the critical time and location downstream for minimum DO? .... (10)

Knowing that:

- Deoxygenation constant = 0.2 /day

- Average flow speed = 0.3 m/s

- Average river depth = 3.0 m

- Saturated DO = 9.1 mg/L

- Neglect temperature correction.

Use the following formulas:

$$K_2 = \frac{3.9\, V^{1/2}}{H^{3/2}}$$

$$t_c = \frac{1}{K_2 - K_1} \ln \left\{ \frac{K_2}{K_1} \left(1 - \frac{Do\,(K_2 - K_1)}{K_1\, Lo} \right) \right\}$$

End of Exam - Good luck

Question Number	Q1	Q2-a	Q2-b	Q3-a	Q4-a	Q2	Q3-b	Q4-a			Q2	Q3-b	Q4-b		
Skills	a1-1	a1-2	a1-1	a1-2	a1-2	b2-1	b2-1	b2-1			c1-1	c1-1	c1-1		
	Knowledge &Understanding Skills					Intellectual Skills					Professional Skills				

This exam measures the following ILOs