

Student Name: ----- NO. -----

**Question 1: (10 points):** Physical and chemical analysis of treated wastewater shown in the following table:

pH	8.9	Na (mg/l)	600
EC (ds/m)	2.0	Ca (mg/l)	150
BOD (mg/l)	60	Mg (mg/l)	120
TSS (mg/l)	75	Molecular weights: Na <sup>+</sup> = 23, Ca <sup>++</sup> = 40 and Mg <sup>++</sup> = 24	
Cl (mg/l)	1000		

a) Calculate the Sodium Adsorption Ratio (SAR)

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b) The leaching requirements for **sensitive crops (Threshold 1.5 ds/m)** irrigated by drip system-----

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c) In case such wastewater quality is used for drip irrigation. What is recommended in case of:

TSS:-----

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pH:-----

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Permeability:-----

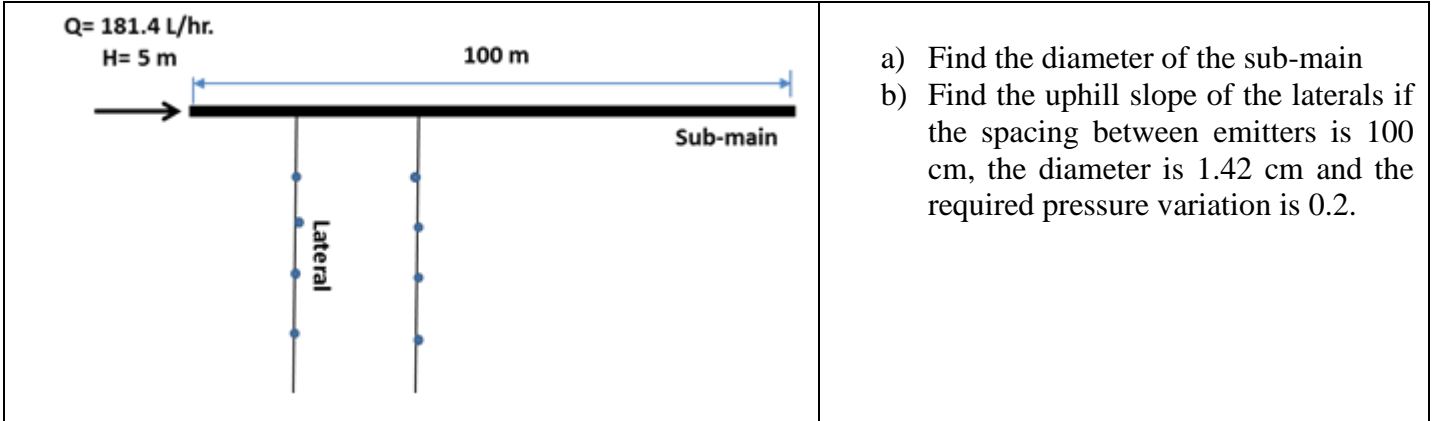
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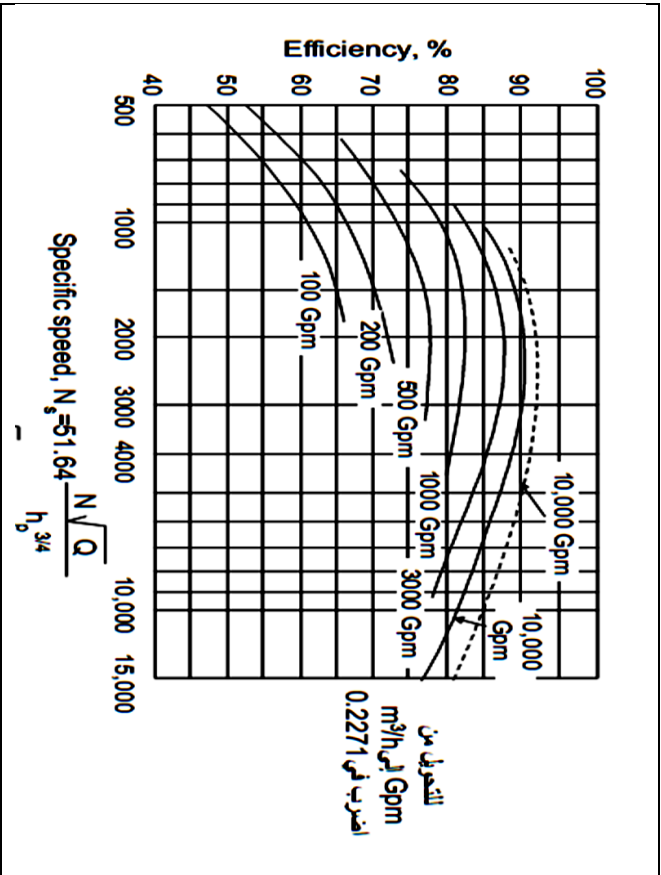
**Question 4: (20 Points).** A garden has 100 m long flat sub-main. The total required irrigation water is 181.4 L/hr. The sub-main feeding 50 laterals installed at 2 m distance. Each lateral has 48 emitters. The inlet pressure of the sub-main is 5 m and the required pressure variation is 0.1. Assume the laterals has equal inlet pressure of 3.17 m as shown in the figure below.



- a) Find the diameter of the sub-main
- b) Find the uphill slope of the laterals if the spacing between emitters is 100 cm, the diameter is 1.42 cm and the required pressure variation is 0.2.

**جدول (1-1) بعض مواصفات المضخات التوربينية**

السرعة rpm	السمت لكل مرحلة (m)		السعة m <sup>3</sup> /h		قطر أنبوب البئر (mm)	التوديل
	إلى	من	إلى	من		
2880	4.6	2.44	18	4.5	100	4S
1440	3.05	1.52	39	18	150	6S
2880	10.7	6.1	78	45	150	6S
1440	4.57	2.44	59	27	200	7S
2880	15.25	8.8	118	64	200	7S
1440	5.2	3.35	91	45	200	8S
1440	7.0	3.05	173	73	250	9S
1440	7.6	2.05	249	114	250	10S
1440	11.6	6.1	363	182	300	12S
1440	14.65	9.75	546	363	350	14S
1440	19.85	7.64	756	450	400	16S
1440	27.4	14.65	1452	907	500	20S
1440	37.8	24.4	2160	1365	600	24S



$$LR = \frac{EC_i}{(2 \max) \times EC_e}$$

$$LR = \frac{EC_i}{5EC_e - EC_i}$$

$$SAR = \frac{Na^+}{\sqrt{\frac{Ca^{++} + Mg^{++}}{2}}}$$

Effective precipitation empirical formula

$P_e = 0.8 * P - 25$  for average rainfall (P) > 75 mm/month  
 $P_e = 0.6 * P - 10$  for average rainfall (P) < 75 mm/month

$$E_{crop} = E_{ref} \times K_c$$

$$K = \frac{K_3 q^{1.852}}{C^{1.852} * S_p^{1.852} * D^{4.871}}$$

$K_3 = 7.94 \times 10^6$  for SI Units.  
 $q$  = Average emitter flow, (L/s)  
 $S_p$  = The emitter spacing, (meters).

$$L = \frac{H_{var} * H}{K * L^{1.852} + S_o}$$

H = Inlet pressure (m),  $H_{var}$  = Pressure variation  
 $S_o$  = Land slope, C= 150

