Kafr Elsheikh University
Faculty of Engineering
Department of Civil Engineering
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Full mark: 85

Sanitary Engineering CES 4123
First Term Exam
4th year Civil Eng
Time :3 hrs.

كراسة الإجابة تستخدم فقط كمسودة . جميع الفقرات متساوية في الدرجات .

بعد الإجابة في المسودة يتم اختيار الإجابة المناسبة من الجدول المرفق لكل سؤال ثم التظليل في الاستمارة المرفقة .

Question (1) Assume that the population of Mansoura and Kafr Elsheikh are doubled every 42 and 21 years respectively. In addition, Mansoura's population was 1.5 time the Kafr Elsheikh's on 2005. After assuming geometric growth rate, the populations of two cities are equal on year….(1)….

1	A	2030	B	2040	C	2050	D	2060

Question (2): If the design flow of the raw water from intake is 120000 m^3/d, the design flow of the water that enter to plant is ….(2)…., the design flow of the treated water that exit from this plant is ….(3)…. and the design flow in the network of the city is ….(4)…., if the water consumption 250 l/c/d then population of the city is ….(5)…. capita

2	A	77922	B	85714	C	109091	D	194805
3	A	85714	B	194805	C	109091	D	77922
4	A	77922	B	85714	C	194805	D	109091
5	A	342856	B	311688	C	436364	D	779220

Question (3) For a water purification plant of capacity 19000 m^3/day shown in figure 1, Determine:

- If detention time of rapid mixing of 60 sec & $\mu = 10 * 10^{-3}$, cubic tank, N=1, and $G = 900\ sec^{-1}$, determine: V=….(6)…. m^3, L=….(7)….m, d=….(8)….m and p=….(9)….watt

- If the rapid mixing tank will blend 30 mg/L of alum with the flow, then Quantity of alum added (ton/month) = ….(10)…..

- For the taper flocculator tank, average G value 30 (sec^{-1}), $GT=5 * 10^4$, assume d=….(11)….(m) , then t=….(12)….(min), V= ….(13)….(m^3), from the figure, the axis of the paddle….(14)….to the width of the tank, then the type of paddle is …..(15)…. and ….(16)…., B= ….(17)….(m), L=….(18)….(m), the total power for flocculator =….(19)…. (watt) and the power of third compartment is ….(20)….(watt)

- If over flow rate in sedimentation tank is 30 $m^3/m^2/d$ and d = 4 m determine:

a. S.A = ….(21)…. m^2
b. B = ….(22)…. m
c. L = ….(23)…. m

d. check v_h =…. (24)…. m/min

e. over flow wire (O.F.W) =….(25)….$m^3/m/d$ · → ….(26)….

f. volume of sludge (if S= 400 mg/l, E=90%, w_c= 97% and $\gamma = 1.05 t/m^3$) = ….(27)…. m^3/d and net water production =….(28)…m^3/d.

6	A	13.19	B	11.11	C	17.36	D	20.32
7	A	2.8	B	2.6	C	2.4	D	2.2
8	A	2.4	B	3.5	C	4.5	D	1.5
9	A	14236.56	B	8624.88	C	11197.44	D	17781.12
10	A	17.1	B	14.4	C	22.5	D	32.8
11	A	6.25	B	3.25	C	1.25	D	5.25
12	A	27.78	B	1666.67	C	45.28	D	2322.52
13	A	482.29	B	308.66	C	366.5	D	879.7
14	A	parallel	B	vertical	C	diagonal	D	intersect
15	A	diagonally	B	longitudinally	C	vertically	D	transversally
16	A	L=3d	B	B=3d	C	L=3B	D	L=B
17	A	9.75	B	11.6	C	10.25	D	12.50
18	A	9.75	B	11.6	C	10.25	D	12.50
19	A	425	B	521	C	337	D	654
20	A	76.6	B	110.4	C	150	D	50.21
21	A	824.55	B	316.66	C	263.88	D	633.33
22	A	11.6	B	9.75	C	10.25	D	12.5
23	A	32.477	B	54.6	C	25.74	D	71.08
24	A	0.28	B	16.8	C	0.020	D	0.322
25	A	1853.65	B	1948.71	C	1637.93	D	1520
26	A	Un safe	B	Safe	C	-------	D	------
27	A	421.25	B	671.57	C	295.55	D	217.14
28	A	18782.86	B	189328.43	C	18704.45	D	18578.75

Ouestion (4)

For a city of population 80 000 capita find the required ground tanks if the daily WC as follows, if the working hours per day of the plant 16 hrs, calculate the following:

T	12-2	2-4	4-6	6-8	8-10	10-12	12-2	2-4	4-6	6-8	8-10	10-12
WC	4	8	12	20	24	32	40	28	16	8	4	4

a. Q_{ave} = ….(29)…. m^3/d

b. water concumption = ….(30)…. l/c/d

c. volume of ground tank
   - form disinfection , (take t = 0.5 hr) = ….(31)….m^3
   - from emergency case, (take t=8 hrs)= ….(32)…m^3
   - from different between max.daily and max.monthly case =...(33)...m^3
   - total volume = ….(34)…. m^3

d. fire demand = ….(35)….m^3

e. assume d = 5 m, L = 50 m and N= 2 , B =….(36)….m

29	A	16000	B	24000	C	17600	D	22400
30	A	240	B	200	C	180	D	133
31	A	1200	B	200	C	700	D	500
32	A	8000	B	11200	C	16800	D	6240
33	A	1200	B	9600	C	3500	D	20300
34	A	15246	B	10368	C	11968	D	17268
35	A	480	B	960	C	240	D	1920
36	A	20	B	24	C	30	D	35

Question (5)

- For the following network shown in figure(2) find the :

a. Δh_{AB} = ….(37)…. m

b. Δh_{BC} = ….(38)…. m

c. Δh_{CD} = ….(39)…. m

d. The head required for a booster pump located at (C) to maintain minimum pressure at D = 25 m is ….(40)…. m

e. Q_{CD} = ….(41)…. m^3/d

- sewer line of diameter 300 mm, Q_{max}= 30 L/sec, Q_{min} = 10 L/sec, S= 0.003 is collected in one main sewer line with diameter 500 mm, Q_{max} = 130 L/sec and S = 0.002 as shown in figure 3, determine the minimum level of sewer pipe ….(42)….

37	A	13	B	10	C	7	D	5
38	A	7	B	10	C	13	D	18
39	A	13	B	10	C	3	D	7
40	A	10	B	15	C	12	D	25
41	A	8640	B	5184	C	0.1	D	Another solution
42	A	(0.200)	B	(0.300)	C	(0.372)	D	(0.285)

Question (6)

- An activated sludge system is to be used for secondary treatment of 13000 m^3/d of municipal wastewater. After primary treatment, the BOD is 180mg/L and it is desired to have not more than 5 mg/L of soluble BOD in effluent. A completely mixed reactor is to be used, and pilot plant analysis has established the following kinetic values Y= 0.5 kg/kg, K_d= 0.050 d^{-1}. Assuming a MLSS concentration of 3000 mg/L and an underflow

concentration of 10000 mg/L from secondary clarifier, its required to determine:-

- Volume of reactor ….(43)…. m^3
- Volume of solids wasted daily ….(44)…. m^3
- Mass of solid wasted ….(45)…. m^3
- Return sludge flow rate ….(46)…. m^3
- Sludge recycle ratio ….(47)…. %
- F/M = ….(48)…. kg_{BOD}/kg_{MLSS} d
- Area of finally sedimentation tank =….(49)…. if S.L.R=24 m/d

- Its required to design Deceleration tank, Approach cannel and screen for W.W.T.P of hourly flow = 5000 m^3
  - Deceleration tank : *Let D. T* = ….(50)…. *min*
    V= …. (51)….m^3
    Let d = ….(52)…. m ,
    but ….(53)…., then B=….(54)….m
  - Approach channel: Let v = ….(55)…. m/sec
    A = ….(56)…. m^2
    for best hydraulic section ….(57)….
    d = ….(58)….m
  - Screen: Let width of bars(φ) = 1.5 cm, Spacing = 5 cm , $\theta = 45°$
    d= ….(59)…. m
    L = ….(60)….m

    Assume net area = 2 area of approach channel = ….(61)….m^2
    No of spacing = ….(62)…. space
    Take 2 screens → No. of pars in each screen = ….(63)…. bars
    b = ….(64)…. cm

    Check, Horizontal velocity before screen (v_1) = ….(65)…. m/s
    v_1 ….(66)…. v_{1check} → ….(67)….
    velocity through screen v_2 ….(67)…. m/s

43	A	2527.8	B	758.34	C	3247.25	D	2600
44	A	92.36	B	85.933	C	55.24	D	75.83
45	A	758.3	B	227.49	C	859.33	D	257.799
46	A	3265.21	B	6245.3	C	4424.5	D	5463.1
47	A	42	B	55	C	59	D	60
48	A	1	B	0.5	C	0.8	D	0.3
49	A	541.66	B	834.16	C	321.24	D	Another solution
50	A	15	B	4	C	10	D	0.5
51	A	10000	B	166.67	C	6.94	D	200.24
52	A	3	B	1	C	4	D	0.5

53	A	L = 3d	B	B= 3L	C	L= 3B	D	B = 3d
54	A	22.5	B	7.5	C	3	D	15.2
55	A	0.3	B	1.2	C	1.7	D	0.1
56	A	3.42	B	2.25	C	1.16	D	5.24
57	A	L=2B	B	B=2d	C	B=2L	D	d=2B
58	A	1.6	B	0.8	C	1.8	D	0.6
59	A	1.8	B	1.6	C	0.8	D	Another solution
60	A	1.13	B	2.54	C	3.21	D	4.22
61	A	5.26	B	2.56	C	6.52	D	3.42
62	A	23	B	54	C	46	D	36
63	A	32	B	28	C	19	D	24
64	A	151	B	205	C	100	D	110
65	A	0.41	B	0.57	C	0.72	D	0.63
66	A	=	B	>	C	<	D	----
67	A	safe	B	un safe	C	----	D	-----
68	A	0.89	B	2.5	C	1.8	D	0.01

Figure 1

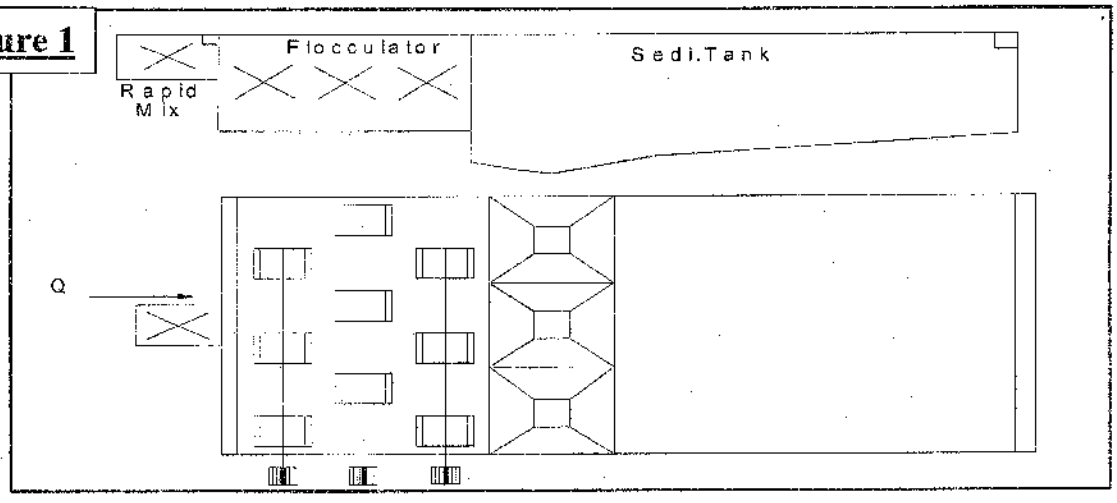


Figure 2

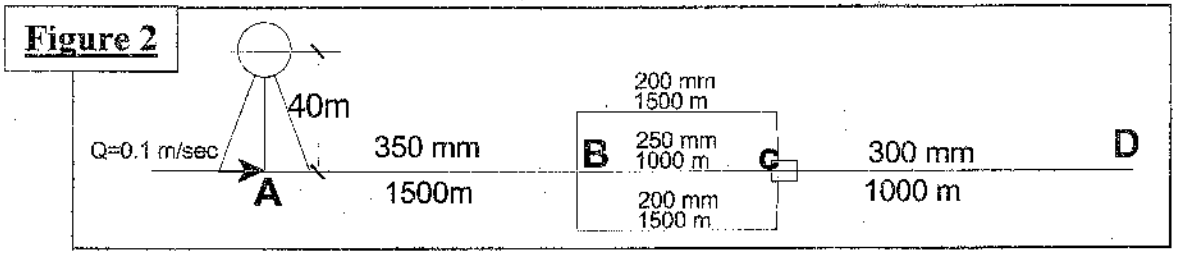
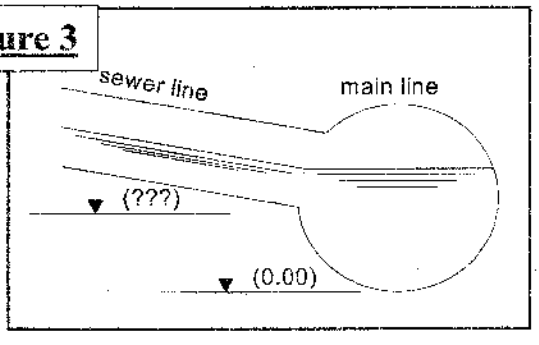


Figure 3



Best regards

Dr. Ahmed Sobhy