

06CE6033

Reg. No _____
Name _____

A P J ABDUL KALAM TECHNOLOGICAL UNIVERSITY

M.TECH DEGREE EXAMINATION, DECEMBER 2015

FIRST SEMESTER

Branch: Civil Engineering

Specialization: Environmental Engineering

Principle and Design of Physico-Chemical Treatment

Time: 3 Hours

Max. Marks: 60

PART A

Answer ALL questions

Provide graph paper

1. List the physical characteristics of water as per potability standards. Describe the methodology with which each of these characters is evaluated.
2. Explain the working of Clariflocculator with a neat sketch.
3. Draw a typical layout of municipal wastewater treatment plant taking water from a stream. List out the treatment plant units with their functions.
4. Write a note on Adsorption Isotherm. Explain the kinetics of Activated Carbon Adsorption.

(4 x 5 marks =20 marks)

PART B

5. Why aeration used in water –treatment plants? Is it more commonly used with ground water or surface water? Why? Explain the working of different types of aerators with a neat sketches and efficiency. Write a note on principle of gas transfer.

OR

6. What are the mechanisms of purification in water filtration? Differentiate Rapid sand filter and slow sand filter with neat sketches.
7. Design and sketch a rectangular plain sedimentation basin to treat 7.5Mld of water for a town. Particles of 0.018mm dia & Sp. Gravity 2.65 are to be

A
15/12/16

1

removed to 75%. Assume Good performance for the plant ($n = \frac{1}{4}$). v at 20°C is $1.01 \times 10^{-6} \text{m}^2/\text{s}$.

OR

8. What is the need of Coagulation cum Sedimentation treatment? What are the component parts of treatment? Design rectangular flocculation cum sedimentation basin to treat 3Mld of water for a town. Draw the neat sketch showing Flocculation zone, settling zone and sludge zone.
9. Find the capacity of equalization tank for the wastewater treatment plant of a town with the fluctuations in flow as given below (use graphical method). Calculate the constant rate of outflow from equalization tank.

Time Period	Flow Rate (m^3/s)	Time Period	Flow Rate (m^3/s)	Time Period	Flow Rate (m^3/s)
M - 2	0.250	8 - 10	0.380	4 - 6	0.320
2 - 4	0.150	10 - N	0.430	6 - 8	0.350
4 - 6	0.110	N - 2	0.410	8 - 10	0.400
6 - 8	0.160	2 - 4	0.360	10 - M	0.350

OR

10. List out the different types of settling basins used in wastewater treatment plant for the treatment of wastewater and the separated sludge. What is the need of using multiple units working on the same principle? Differentiate the working of each system based on their major design elements.
11. Explain membrane fouling mechanisms. What are the corrective measures against membrane fouling? Evaluate the membrane area required for treating brackish water of TDS 3000gm/l. The membrane is having a flux rate coefficient of $1.5 \times 10^{-6} \text{ s/m}$. The permeate flow rate is to be $0.010 \text{m}^3/\text{s}$. The net operating pressure will be 2500kPa.

OR

12. What is meant by softening of water? What are the different methods of water softening? Differentiate between single-stage and two stage softening process. What is the need of re-carbonation after chemical softening? Discuss different methods of re-carbonation.

(4 x 10 marks =40 marks)

06CE6033

Reg. No _____

Name _____

A P J ABDUL KALAM TECHNOLOGICAL UNIVERSITY**M.TECH DEGREE EXAMINATION, DECEMBER 2016****FIRST SEMESTER****Branch: Civil Engineering****Principle and Design of Physico-Chemical Treatment****Time: 3 Hours****Max. Marks: 60****PART A***Answer ALL questions*

1. Explain any one method of aeration. Which source of water aeration is insisted? Why?
2. Draw a typical layout of municipal water treatment plant taking water from a stream. List out the treatment plant units with their functions.
3. What is the importance of grit removal in wastewater treatment? What are the different type grit chambers used in the wastewater treatment plants.
4. Write notes on different membrane treatment systems.

(4 x 5 marks =20 marks)**PART B**

5.
 - i. Explain the principle mechanisms of coagulation.
 - ii. Differentiate between coagulation and flocculation. **(5 + 5)**

OR

6. What is surface overflow rate? Derive the effect of surface overflow rate on the efficiency of an ideal settling basin. Find the minimum size of the particle with 100% settling efficiency in an ideal sedimentation basin with a surface overflow rate of $24\text{m}^3/\text{d}/\text{m}^2$.
7. Explain the principle of chlorination. List different types Chlorination with corresponding dosages. Draw & Explain the Break Point Chlorination Curve.

OR

8. Explain the working of a Rapid Sand Filter. Design rapid sand filter box to treat 12 Mld of water, allowing 4% of excess filtered water for backwashing. Half hour per day is used for back washing. Draw the neat cross section of the filter.
9. 'A wastewater treatment plant functions with multiple number of sedimentation basins in the flow line'. List and explain the functions of each basin arranged in the flow line of the treatment plant with their individual settling type.

OR

10. Explain the working principle of Bar rack with its cross-sectional sketch and design elements. Design a screen chamber for population 50000 with water consumption of 135 LPCD.
11. Explain Oxidation of Refractory organic compounds in treated effluent? What is the principle of advanced oxidation by ozone & Hydrogen peroxide by producing hydroxyl radicals?

OR

12. Evaluate the chemical requirement of softening: Raw water constituents given in table below: (Atomic wt: Ca – 40, Na – 23, Cl – 35.5, C – 12, O – 16)

$\text{Ca}^{2+} = 4.7$	$\text{Mg}^{2+} = 1.0$	$\text{Na}^+ = 2.2$	$\text{CO}_2 = 0.6$
$\text{HCO}_3^- = 2.5$	$\text{SO}_4^{2-} = 2.9$	$\text{Cl}^- = 2.5$	

(Consider re-stabilize the water. No Mg^{2+} removal is required).

- A. Draw the bar diagram of raw water.
- B. Calculate the daily requirement of lime and soda ash (assume purity of 85% for the lime and 90% for soda ash) to treat 12Mld of the water.
- C. Draw a bar diagram of the finished water.

(4 x 10 marks =40 marks)

06CE6033

Reg. No _____

Name _____

C

A P J ABDUL KALAM TECHNOLOGICAL UNIVERSITY

M.TECH DEGREE EXAMINATION, DECEMBER 2017

FIRST SEMESTER

Branch: Civil Engineering

Specialization: Environmental Engineering

Principle and Design of Physico-Chemical Treatment

Time: 3 Hours

Max. Marks: 60

PART A

Answer ALL questions

4 X 5 Marks

1. What is E-coli? Describe 'E-coli an indicator Organism'.
2. Differentiate the working of dry and wet coagulant feeders with neat sketches.
3. Draw a typical layout of municipal wastewater treatment plant discharging the treated effluent to a stream. List out the treatment plant units with their functions.
4. Where do we prefer an Equalization system in treatment chain, water or wastewater? What is its function?

PART B

4 X 10 Marks

5.
 - a. What is aeration? What are objectives of aeration? List any two methods of aeration working as per dispersion of water in air.
 - b. Differentiate between coagulation and flocculation. (5 + 5)

OR

6. Derive constant settling velocity of a spherical particle having higher specific gravity than water. A spherical silica particle of diameter 0.05mm and specific gravity 2.65 is settling in water. The dynamic viscosity of water, $\mu = 1.002 \times 10^{-3} \text{ N/sec.m}^2$. Find the settling velocity of particle. Check the particle obey Stock's law.

7. Design rapid sand filter box to treat 10 Mld of water, allowing 3% of filtered water for backwashing. Half hour per day is used for back washing. Explain the working with a neat cross section of the filter. Assume other necessary data.

OR

8. A rectangular sedimentation is to treat water for a town of expected forecasted population of 100000. Average water demand of the area 120 lpcd with a peak factor 1.5. The sedimentation basin of width to length ratio of 1/3 is proposed to trap all particles larger than 0.05mm size and specific gravity 2.65. Find the basin dimensions and detention time, given effective depth of the tank as 3m. (Assume ideal settling condition & discrete particle settling) Draw the neat cross section of the sedimentation basin.
9. Explain the need of screening of wastewater. Give the detailed classification of screens with their uses. Estimate the screen requirement for a plant treating a peak flow of 60million liters per day of sewage.

OR

10. List out the different types of settling basins used in wastewater treatment plant for the treatment of wastewater and the separated sludge. What is the need of using multiple units working on the same principle? Differentiate the working of each system based on their major design elements.
11. Evaluate the chemical requirement of softening: Raw water constituents given in table below:
(Atomic wt: Ca – 40, Na – 23, Cl – 35.5, C – 12, O – 16)

$\text{Ca}^{2+} = 70.00\text{mg/l}$	$\text{Na}^+ = 50.60\text{mg/l}$	$\text{CO}_2 = 33.00\text{mg/l}$
$\text{HCO}_3^- = 109.80\text{mg/l}$	$\text{Cl}^- = 142.00\text{mg/l}$	

(Consider re-stabilize the water)

- A. Draw the bar diagram of raw water.
- B. Calculate the daily requirement of lime and soda ash (assume purity of 80% for the lime and 95% for soda ash) to treat 10Mld of the water.
- C. Draw a bar diagram of the finished water. (2 + 5 + 3)

OR

- 12.
- a. Differentiate membrane treatment mechanisms RO and ED.
- b. Explain the treatment - ‘Activated Carbon Adsorption’ (5 + 5)

Exam Slot: C

06CE6033

Reg Number.....

Name.....

A P J ABDUL KALAM TECHNOLOGICAL UNIVERSITY
M.TECH DEGREE EXAMINATION, DECEMBER 2018
FIRST SEMESTER
ENVIRONMENTAL ENGINEERING
Principle and Design of Physico-Chemical Treatment

Time: 3 Hrs

Maximum Marks:60

PART A

Answer ALL Questions

1. Why aeration used in water treatment plants? Is it more commonly used with ground water or surface water? Why?
2. Define Disinfection. What are the ideal characteristics of disinfectant? Write a note on disinfection of well.
3. Write note on systems of Grit removal.
4. Explain the working principle of Ion exchange treatment. Where do we prefer Ion exchange as a method of treatment? Write a note on regeneration.

4 x 5 marks = 20 marks

PART B

5. What are the qualities of potable water as per IS10500? Explain different tests conducted for the evaluation.

OR

6. What is surface overflow rate? Derive the effect of surface overflow rate on the efficiency of an ideal settling basin. Find the minimum size of the particle having complete removal in an ideal sedimentation basin with a surface overflow rate of $20\text{m}^3/\text{d}/\text{m}^2$.
7. Compare the sizes of Rapid sand filter basin and slow sand filter basin to get treated water at a rate of 3MLd of water for a town. Draw neat sketches of Filter cross section.

OR

8. What is Chlorination? Explain the chemical principle. Explain different forms of chlorination?
9. Describe different units used in sludge treatment plant.

OR

10. What is meant by preliminary treatment of wastewater? Explain different stages of preliminary treatment.
11. A dairy industry is working in 3 similar shifts, so that plant is working in 8 hr cycles. Design an equalization tank for the ETP as per the given effluent flow data (8am to 4pm). Evaluate the capacity of Equalization tank and calculate the designed Flow rate of the ETP.

Time Period	Flow Rate (m^3/s)	Time Period	Flow Rate (m^3/s)
8 - 9	0.22	12 - 1	0.36
9 - 10	0.14	1 - 2	0.44
10 - 11	0.11	2 - 3	0.42
11 - 12	0.16	3 - 4	0.36

OR

12. What is meant by softening of water? What are the different methods of water softening? Differentiate between single-stage and two stage softening process. What is the need of re-carbonation after chemical softening? Discuss different methods of re-carbonation.

4 x 10 marks = 40 marks