

Reg.No. _____



Karunya UNIVERSITY

(Karunya Institute of Technology & Sciences)

(Declared as Deemed-to-be University under Sec.3 of the UGC Act, 1956)

End Semester Examination – Nov/Dec – 2016

Code : **14CE3040**
 Sub. Name : **Water and Wastewater Treatment**

Semester : **2016-17 ODD**
 Duration : **3hrs**
 Max. marks : **100**

ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)

Q. No.	Sub Div.	Questions	Course Outcome	Marks
1.	a.	How is water quantity estimated? Explain the factors affecting per capita demand.	CO 1	8
	b.	Draw the layout of drinking water treatment plant and wastewater treatment. Describe physical, chemical and biological methods of waste water treatment	CO 1	10
	c.	1. For removing the fine and light colloidal impurities in water, the dosage of coagulant primarily depend on (a) colour (b) pH value (c) temperature (d) time of settlement 2. For a grit chamber, if the recommended velocity of flow is 0.2 m/s and detention time is 3 min, the length of the chamber is (a) 36 m (b) 48 m (c) 60 m (d) 24 m	CO 1	2
(OR)				
2.	a.	List down the various characteristics of wastewater and explain in detail about environmental significance of each parameter	CO 1	7
	b.	1. The first stage of natural process of sludge digestion is (a) acid fermentation (b) acid regression (c) alkaline fermentation (d) none of the above 2. To test the COD of sewage, the organic matter is oxidized by potassium dichromate in the presence of (a) hydrochloric acid (b) sulphuric acid (c) nitric acid (d) citric acid 3. In plain sedimentation tank, the suspended solids are reduced from (a) 10 to 20% (b) 20 to 40% (c) 40 to 70% (d) 70 to 90% 4. Alum increases (a) hardness of water (b) sulphates in water (c) acidity of water (d) carbonates of water 5. The non-chemical method of disinfection is (a) chlorination (b) coagulation (c) boiling (d) sedimentation 6. Particles of around one micron are best removed by (a) filtration (b) chemical coagulation (c) plain sedimentation (d) chemical precipitation	CO 1	3
	c.	Write short notes on 1. Head loss in filtration and screening 2. Attached growth and suspended growth process 3. Hydraulic detention time 4. Oxygen demand in wastewater treatment	CO 1	10
3.	a.	Explain in detail about the process of screening with design principles and schematic diagram?	CO 3	7
	b.	Write in detail about the working principle of a horizontal flow sedimentation basin. What are the design parameters involved.	CO 3	6
	c.	What is flocculation? What are the common aids used to make the process more thorough? Differentiate between discrete particles and flocculent particles of sedimentation	CO 3	7

(OR)				
4.	a	A plain sedimentation tank has dimensions 100m x 50 m x3m (LxWxD) and receives flow of $10^5 \text{ m}^3/\text{day}$. Calculate Surface Overflow Rate (S.O.R) and diameter of smallest particle which will be removed 100%. Assume discrete settling and no short circuiting. Density of particles = 2.65 g/cc and kinematic viscosity = $1.02 \times 10^{-2} \text{ cm}^2/\text{s}$.	CO 3	8
	b	Answer the following: 1. The BOD of safe drinking water is (a) 15 (b) 10 (c) 5 (d) zero 2. The backwash arrangement is made only in the case of (a) a rapid sand filter (b) slow sand filter (c) sedimentation tank (d) coagulation tank 3. The maximum permissible chloride content in water for domestic supplies should not exceed (a) 150 ppm (b) 250 ppm (c) 350 ppm (d) 450 ppm 4. Hardness due to calcium bicarbonate can be removed by (a) boiling (b) lime process (c) lime-soda process (d) zeolite process ppm is the same as (a) 5 gm per gallons of water (b) 5 gm per litre of water (c) 5 mg per litre of water (d) 5 kg per tonnes of water	CO 3	3
	c	Explain the working principle of aerated grit chamber with schematic diagram. List down the design parameters.	CO 3	9
5.	a	Discuss in detail the classification of microorganisms and kinetics of microorganisms in activated sludge process	CO 3	5
	b	Explain the anaerobic digestion process using flow chart. What are the different types of anaerobic reactors	CO 3	7
	c	Calculate the population equivalent of a city given (i) the average sewage from the city is $95 \times 10^6 \text{ l/day}$ and (ii) the average 5-day BOD is 300 mg/l	CO 3	3
	d	List down the comparative characteristics of trickling filter and the activated sludge process	CO 3	5
(OR)				
6.	a	Design a continuous flow stirred tank activated sludge process to treat $0.3 \text{ m}^3/\text{s}$ of settled wastewater having 225 mg/l of BOD. The effluent is to have 25 mg/l of BOD or less. Assume the temperature to be 20°C . The following conditions are applicable. 1. Ratio of mixed liquor volatile suspended solid to mixed liquor suspended solids = 0.8 2. Return sludge concentration = 12000 mg/l of suspended solids 3. Mixed liquor volatile suspended solids = 4000 mg/l 4. Design mean cell residence = 10 days 5. Effluent contains 20 mg/l of biological solids of which 65% is bio-degradable 6. The one day sustained peak rate is 2.5 times the average rate of flow	CO 3	20
7.	a	Write short notes on a. Ion exchange process in water softening b. Adsorption and its types c. Disinfection d. Characterisation of sludge using SEM	CO 1 & CO 2	10
	b	Explain in detail about mechanisms involved in removal of solids in filtration process. List down types of filtration	CO 1 & CO 2	6
	c	List down the factors affecting the filtration process	CO 1 & CO 2	4
OR				

8.	a	Write in detail about the principle involved in bioremediation of wastewater. Differentiate between in-situ and ex-situ bioremediation	CO 3	6
	b	Briefly explain about aeration in wastewater treatment. List down different types of aerators used in removal of iron and manganese	CO 3	8
	c	How XRD and EDAX analysis is helpful in wastewater characteristics	CO 1 & CO 2	6
<u>COMPULSORY</u>				
9.	a	Mention the different methods of forecasting the future population of a given town. Describe in detail the incremental increase method and geometric increase method	CO 1 & CO 2	12
	b	Mention and describe the various purposes for which water is supplied to a modern industrial town	CO 1 & CO 2	8

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