Roll No. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. (Full Time) - END SEMESTER EXAMINATIONS, NOV/DEC 2024

CIVIL ENGINEERING

V Semester

CE 5503 WASTEWATER ENGINEERING

(Regulation 2019)

Time: 3hrs

Max.Marks: 100

PART- A (10 x 2 = 20 Marks)
(Answer all Questions)

CO1	Understand on the characteristics and composition of sewage ,ability to estimate sewage generation and design sewer system including sewage pumping stations
CO2	Select type of treatment system and able to perform basic design of the unit operations that are used in sewage treatment. knowledge of septic tank design
CO3	Gain knowledge of selection of treatment process and biological treatment process
CO4	Acquire knowledge of advance treatment technology and reuse of sewage
CO5	Understand the, self-purification of streams and sludge and septage disposal methods.

BL 1 Remember BL2 Understand BL3 Apply BL4 Analyze BL5 Evaluate BL6 Create

Q. No	Questions	Marks	CO	BL
1	When does it become necessary to provide manhole in sewerage system?	2	1	1
2	What is trap? State its quality requirements.	2	1	2
3	What is a unit process?	2	2	1
4	State any two objectives of screening operations	2	2	1
5	What is an example of symbiotic relationship between algae and bacteria?	2	3	2
6	Distinguish between suspended growth processes and attached growth processes with suitable examples.	2	3	2
7	What role does pre-anoxic tank play in MBR system?	2	4	2
8	Write down the components of UASB reactor.	2	4	2
9	100 m^3 of sludge holds a moisture content of 98%. If its moisture content changes to 95 %, what will the volume of this sludge be?	2	5	4
10	Define Sodium Adsorption Ratio.	2	5	1

PART- B (5 x 13 = 65 Marks)

Q. No	Questions	Marks	CO	BL
11 (a)	Explain the various sources of wastewater and also discuss the characteristics of wastewater.	13	1	1
	(OR)			
11 (b)	Design a branch sewer to serve a population of 15000, the daily per capita water supply allowance being 135 litres, of which 80%, find its way into the sewer. The slope available for the sewer to be laid is 1 in 625 and the sewer should be designed to carry four times the dry weather flow, when running full. What would be the velocity of flow in the sewer when running full?	13	1	4
12(a)	Design a circular primary settling tank for a proposed STP expected to treat 40 MLD of preliminary treated sewage. Draw a neat sketch of the unit.	13	2	2
	(OR)			
12 (b)	Describe the steps involved in the design of septic tank and also explain the working with a neat sketch.	13	2	2
13 (a)	Explain the working principle of a trickling filter with the help of a neat sketch. Also discuss the design criteria pertaining to it.	13	3	1
	(OR)			
13 (b)	Design a continuous flow conventional ASP plant with diffuser aeration facility to treat 50 MLD municipal sewage. The BOD_3 (@27°C) of raw sewage is 300 mg/L. Assume the following operational parameters. MLSS in the aeration tank = 3000 mg/L F/M ratio = 0.35	13	3	3
14 (a)	Explain the working principles of MBBR system with suitable diagram. Also briefly outline the design procedure.	13	4	1
	(OR)			
14 (b)	It is proposed to treat preliminary treated sewage of 50 MLD with the help of a SBR system. The BOD_3 (@27°C) of raw sewage is 300 mg/L. TKN content of raw sewage as 45 mg/L. Design the various components of SBR system by assuming suitable criteria.	13	4	3

15 (a)	What are the sinks and sources of oxygen in the oxygen sag model? Develop a DO model for oxygen sag curve as per Streeter Phelps' approach.	13	5	2
	(OR)			
15 (b)	A sewage treatment plant of 20 ML/d design capacity consists of primary treatment units followed by an ASP secondary system. The primary and secondary sludge are mixed and then thickened in a gravity thickener and sent for further treatment. Design the geometry of gravity thickener and volume reduction by the thickener. The data pertaining to STP are furnished below:	13	5	3

Raw sewage	ASP parameter	Sludge(Solid content %)
BOD= 300 mg/l	Y= 0.45	Primary = 2.5
TSS = 350 mg/L	k_d =0.05 d^{-1}	Secondary = 1.0
VSS = 260 mg/L	θ_c= 8 d	Thickened = 4.5
	f_d = 0.15	

PART- C (1 x 15 = 15 Marks)

(Q.No. 16 is Compulsory)

Q. No	Questions	Marks	CO	BL
16.	Design a MBR system for a proposed STP for a design capacity of 30 MLD. Assume suitable design criteria as applicable. The characteristics of raw sewage is given below. BOD_3 (@27°C) of raw sewage : 300 mg/L TSS concentration of raw sewage : 250 mg/L TKN concentration of raw sewage : 45 mg/L	15	4	3

CONTROLLER OF EXAMINATIONS ADDITIONAL AU CHENNAI 600 025