MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

FOURTH SEMESTER B.TECH (CIVIL ENGINEERING)

END SEMESTER EXAMINATION, APRIL-MAY 2024

WASTEWATER MANAGEMENT (CIE 2224)

(05 – 05 - 2024)

TIME: 2:30 – 5:30 **MAX. MARKS: 50**

Note: 1. Answer all questions.
2. Any missing data may be suitably assumed.

Q. NO	QUESTION	MARKS	CO	BL
1A	Explain the basic operation of pneumatic ejectors and airlift pumps with the help of a neat sketch.	**05**	CO1	2
1B	Explain the difference between conservancy and water carriage system.	**03**	CO1	2
1C	Illustrate the application of using P and S trap in conveying sewage to a drainage point with a neat sketch.	**02**	CO1	4
2A	Design a rectangular sedimentation tank for treating the sewage from a city having maximum daily water demand of 2 million liters per day (MLD). Assume a detention time of 2 hours, surface overflow rate (SOR) as 40 $m^3/m^2/d$ and horizontal flow velocity as 0.3 meter/minutes. Assume 85% of water supplied will become sewage. Also, calculate weir loading rate.	**05**	CO3	3
2B	Explain briefly the three steps involved in Most Probable Number test.	**03**	CO2	2
2C	Explain various factors affecting the efficiency of Primary sedimentation tank.	**02**	CO3	2
3A	A single-stage trickling filter is designed for an organic loading of 10,000 kg of BOD in raw sewage per hectare metre per day with a recirculation ratio of 1.5. The filter treats a of flow of 2 MLD with BOD concentration in the influent as 300 mg/l. Determine the strength of the effluent. PST removes 25 % of BOD from raw sewage. Assume depth of filter as 2 m.	**05**	CO4	3
3B	Distinguish between the recirculation process employed in activated sludge process and trickling filters.	**03**	CO4	4
3C	Explain Sludge Volume Index. How is it determined?	**02**	CO4	2
4A	Design a conventional activated sludge plant to treat domestic sewage with diffused air aeration system, given the following data: Flow = 2000 m^3/d; BOD of sewage = 300 mg/l; BOD removed in primary treatment = 30%; Overall BOD reduction = 85%; Assume F/M ratio = 0.4; MLSS concentration = 2500 mg/l; air required per kg of BOD removed = 100 m^3 air/kg BOD; endogenous respiration rate, kd = 0.06; yield coefficient = 0.6.	**05**	CO4	3

	Also find, HRT, sludge age, rate of air supplied and dimensions of aeration tank if depth and width of 3 m and 4.5 m is to provided respectively.			
4B	Illustrate with the help of a neat sketch the contact stabilization process.	**03**	CO4	2
4C	Briefly discuss any two methods used for the control of sludge bulking.	**02**	CO4	2
5A	A town discharges 2000 m^3/d of sewage into a river having a rate of flow of 2.315 m^3/s during lean days at a 5-day BOD of sewage and river as 250 and 2 mg/l respectively. Assume the DO of the stream as DO_{sat} and sewage as 1 mg/l. Determine the amount of critical DO deficit and its location in the downstream portion of the river. Assume deoxygenation coefficient K as 0.1, velocity of stream as 0.2 m/s and coefficient of self-purification (fs) as 3.0. Assume saturation DO at given temperature as 9.2 mg/l.	**05**	CO5	3
5B	Explain the advantages and disadvantages of Rotating Biological Contactor.	**03**	CO4	2
5C	Explain the factors affecting Self-purification of streams.	**02**	CO5	2