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: **MAX. MARKS: 50**

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

Q. NO	QUESTION	MARKS	CO	BL
1A	List different types of pumps used in sewerage system. Explain the working of any two types in detail with the help of a neat sketch	05	CO1	2
1B	Explain the essential components of a house drainage system.	03	CO1	2
1C	Explain in brief the significance of providing ventilation columns in the sewerage system	02	CO2	2
2A	Design a rectangular sedimentation tank for treating the sewage from a city having a maximum daily water demand of 3 MLD. Assume a detention time of 2 hours, surface overflow rate (SOR) as 35 $m^3/m^2/d$ and horizontal flow velocity as 0.25 meter/minutes. Assume 80% of the water supplied will become sewage. Also, calculate the weir loading rate.	05	CO3	3
2B	Explain the significance of i) Ultimate BOD ii) Membrane filtration test iii) COD in wastewater characterization.	03	CO2	2
2C	Explain with a neat sketch the working of a screen chamber.	02	CO1	2
3A	A single-stage trickling filter is designed for an organic loading of 9,000 kg of BOD in raw sewage per hectare meter per day with a recirculation ratio of 1.5. The filter treats of flow of 3 MLD with BOD concentration in the influent as 250 mg/l. Determine the strength of the effluent. PST removes 25 % of BOD from raw sewage. Assume the depth of the filter as 2 m.	05	CO4	3
3B	Explain the various components of the Trickling Filter.	03	CO4	2
3C	Calculate the SVI of wastewater given its MLSS concentration as 2500 mg/l and volume of sludge in 30 minutes detention time is 280 ml/L.	02	CO1	3
4A	Design a conventional activated sludge plant to treat domestic sewage with diffused air aeration system, given the following data: Flow = 3000 m^3/d; BOD of sewage = 250 mg/l; BOD removed in primary treatment = 30 %; Overall BOD reduction = 90 %; Assume F/M ratio = 0.3; MLSS concentration = 2000 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, SRT, rate of air supplied and dimensions of aeration tank if depth and width of 3m and 4.5m is to be provided respectively.			
4B	Explain the working principle of the Activated Sludge Process.	03	CO3	2
4C	Differentiate between the Rotating Boilogical Contactor and Trickling Filter with regard to its working principle.	02	CO3	2
5A	A town discharges 3000 m^3/d of sewage into a river having a rate of flow of 10 m^3/s during lean days at a 5-day BOD of sewage and river as 250 and 5 mg/l respectively. Assume the DO of the stream as DOsat and sewage as 0.5 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	Describe any two techniques employed for sludge thickening.	03	CO5	2
5C	Explain briefly the different zones of purification in stream.	02	CO5	2