MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

VII SEMESTER B. TECH (CIVIL ENGINEERING)
END SEMESTER EXAMINATIONS, 2023
SUBJECT: FECAL SLUDGE AND SEPTAGE MANAGEMENT [CIE 4079]

Date of Exam: /12/2023 Time: 3 hrs. Max. Marks: **50**

Instructions to Candidates:

- Answer ALL the questions & any missing data may be suitably assumed

Q. No.	Question	Marks	CO	BL
1A.	Discuss the sustainable development goal (SDG) focused on the sanitation program.	**3**	**CO1**	**2**
1B.	Explain different routes of fecal sludge generation.	**3**	**CO1**	**2**
1C.	A survey was conducted to estimate the average water required per person in the Municipal Corporation of Nagpur city. The survey estimated an average daily water requirement of 110 liters per person. Design a septic tank for a colony of 250 people. With a suitable scale draw a neat sketch of a septic tank showing all the components. Given: • The average temperature is 30 ºC • Desludging frequency= 3 years • Sewage generation = 85 % of water supply • Average retention time of wastewater in the tank = 24 hours • The annual rate of sludge and scum production= 0.025 m^3/capita/year • The percolation rate is 1200 lit/m^3/day	**4**	**CO1**	**4**
2A.	With a neat sketch explain the facultative pond for treatment of fecal sludge. Explain the design consideration of waste stabilization ponds.	**5**	**CO2**	**2**
2B.	The total solids and suspended solids (test) data on an industrial wastewater sample from Netravati River is given below. Calculate the total, volatile solids, suspended solids, and dissolved solids. Weight of empty dish = 85.337 g Weight of dish plus dry solids = 85.490 g Weight of dish plus ignited solids = 85.375 g The volume of wastewater sample = 80 mL Weight of glass-fiber filter disk = 0.1400 g Weight of disk plus dry solids = 0.1530	**3**	**CO2**	**3**

	Weight of disk plus ignited solids = 0.1426 The volume of wastewater filtered = 500 mL			
2C.	The urease enzyme hydrolyzed the urea at [S]= 0.03 mmol/L with a Km value of around 0.06 mmol/L. The initial velocity observed was $1.5x10^{-3}$ mmol/L.min^{-1}. Calculate the initial velocity of the enzymatic reaction when using [S]= 0.12 mmol/L.	**2**	**CO2**	**3**
3A.	Udupi Township (Population of around 200000) authorities are planning to construct settling-thickening tanks for FS treatment. Each week, one tank will be used for receiving FS while the other tank will be pumped out and cleared from the scum layer. The FS is diluted with an average suspended solids (SS) of 4 g/L. Continuous monitoring of sludge characteristics was conducted, and reported below: Mean daily influent flow = 150 L/capita/day Peak coefficient = 1.8 Daily operating hours of the treatment plant = 8 number of treatment plant operating days per week = 5 Flow velocity = 1 m/h The concentration of SS in thickened sludge= 80 g/L Design a settling-thickening tank for SS settling efficiency of 80%.	**5**	**CO2**	**4**
3B.	Write a short note on the unplanted drying bed and the parameters affecting it.	**3**	**CO2**	**2**
3C.	Describe the role of macrophytes in planted drying beds.	**2**	**CO2**	**2**
4A.	Illustrate with a detailed flowchart the different energy recovery options for fecal sludge.	**3**	**CO3**	**3**
4B.	Explain in brief the different types of composting processes used in the end application of fecal sludge mixed with solid waste.	**4**	**CO3**	**2**
4C.	Discuss the training program for different responsibilities involved at each level during the sanitation and fecal sludge management.	**3**	**CO4**	**2**
5A.	Write the design consideration for the application of stored urine.	**3**	**CO3**	**2**
5B.	Explain SWOT analysis. Illustrate with a SWOT matrix, the influence of fecal sludge management in peri-urban areas in India.	**4**	**CO4**	**4**
5C.	Discuss the monitoring program involved in fecal sludge management.	**3**	**CO4**	**2**