BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
FIRST SEMESTER 2023-2024
COMPREHENSIVE EXAMINATION (OPEN BOOK/NOTES)

COURSE NO.: SAN G511 TIME: 3 Hours
COURSE TITLE: Sanitation Technology DATE: 09/12/2023
MAX. MARKS: 40%

Note: (i) Attempt **all 5** questions. (ii) Make necessary assumptions, if required.

Q.1 You are designing a faecal sludge treatment plant and the client wants to know the required surface area along with number of beds required to operate and maintain the planted drying beds. The treatment plant has an influent faecal sludge TS of 30 kg TS/m^3, operates 6 days a week and receives 50 m^3 faecal sludge a day. Typha Augustifolia plant is suggested and can be operated with a solids loading rate of 250 kg TS/m^2.yr and the hydraulic loading rate is suitable as 7.5 – 15 cm with a loading frequency of twice a week. [8]

Q.2 If 40,000 kg faecal sludge per pile is planned, how can a C : N ratio of 30:1 and a moisture content of 50% be achieved in a co-compost with a mixture of market waste and faecal sludge with the following characteristics?

Type of waste	N%	C%	M (kg)	Moisture Content (wt %)
Faecal sludge	1.5	15	40,000	50
Market waste	1.5	40	?	65

a) Calculate the needed mass of market waste to obtain a 30:1 ratio.
b) Calculate the operating ratio (actual ratio) between faecal sludge: market waste and compare it with the recommended 1:3.
c) Calculate the moisture content for the mixture and compare to the recommended 40-60 % range.

[8]

Q.3(a) At a faecal sludge treatment plant, a series of anaerobic baffled reactors and anaerobic filters are connected as effluent treatment following a settling-thickening tank. Draw a schematic diagram of anaerobic baffled reactors and anaerobic filters. Also, highlight their applicability along with the input and output characteristics. What ate the pros and cons of the Anaerobic Baffled Reactor (ABR) and Anaerobic Filters (AF). [5]

Q.3(b) What size septic tank would you recommend for a 2 bedroom cottage assuming the available tank sizes are: 3000; 4200; 4500; and 5500 liters? Assume you wish to have three days of residence time for the pollutants in the tank. (b) How would your problem change for a 4-bedroom house with a two-day residence time?
[Assume the flow rates 500 liters per day of wastewater flow rate in a bed room for both the cases mentioned above]. [3]

Q.4(a) In an ASP, given the following data:

a. Influent BOD = 300 mg/l
b. Effluent BOD = 30 mg/l
c. Flow rate = 20,000 m^3/day
d. BOD: N: P = 100:5:1
e. Oxygen transfer rate of fixed aerator = 1.4 kg/HP/hr
   Calculate amount of Diammonium Phosphate [$(NH_4)_2HPO_4$] to be added to maintain the P ratio and the required H.P. of the aerators. { N=14 , H=1 , P =31, O=16}. [6]

Q.4(b) Differentiate between Horizontal and vertical Surface Flow Constructed Wetlands. [2]

Q.5(a) Why do we use chlorination technology commonly for disinfection in India? What are the disadvantages of disinfection with the help of chlorination technology? [3]

Q.5(b) Design an oxidation pond for treating sewage from a hot climate colony with 6000 persons, contributing sewage @ 130 litre per capita per day. The 5 day BOD of sewage is 250 mg/l. Also find the Detention time of the tank and draw the diagram of Oxidation pond.

[Organic loading in pond = 300 kg/ha/day , L:B = 2:1 , Depth of tank =1.2 m] [5]

-----WISH YOU ALL THE BEST-----