BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: M.TECH **SEMESTER : II**
BRANCH: ENVIRONMENTAL SCIENCE AND ENGINEERING **SESSION : SP/2023**

SUBJECT: CE532 WASTEWATER ENGINEERING

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	Discuss the physical and chemical characteristics of municipal wastewater	[5]	1	2
Q.1(b)	Calculate the diameter of circular sewer laid at S=0.00001 when it is flowing half full at a velocity of 1 m^3/s (n=0.012).	[5]	1	3

Table 4.8. Proportionate Values of Hydraulic Elements for Circular Sewers when Flowing Partially Full (without being corrected for variations of roughness with depth)

Proportionate Depth d/D (1)	*Proportionate area a/A (2)*	*Proportionate Wetted perimeter p/P (3)*	*Proportionate H.M.D. r/R (4)*	*Proportionate Velocity v/V (5)*	*Proportionate Discharge q/Q (6)*
1.00	1.00	1.00	1.000	1.000	1.000
0.90	0.949	0.857	1.192	1.124	1.066
0.80	0.858	0.705	1.217	1.140	0.988
0.70	0.748	0.631	1.185	1.120	0.838
0.60	0.626	0.564	1.110	1.072	0.671
0.50	0.500	0.500	1.000	1.000	0.500
0.40	0.373	0.444	0.857	0.902	0.337
0.30	0.252	0.369	0.684	0.776	0.196
0.20	0.143	0.296	0.482	0.615	0.088
0.10	0.052	0.205	0.254	0.401	0.021
0.00	0.000	0.000	0.000	0.000	0.000

PTO

Q.2(a)	Design a screw pumping system for Waterloo's WWTP that has the following characteristics: Interceptor sewer Minimum sewage elevation 514 m, Maximum sewage elevation 515 m, Discharge elevation to stilling well 519 m, Average flow rate at design capacity 40,000 m^3/d	[5]	2	5

Typical screw pump selection chart[a]

Screw diameter, m	Maximum rpm	Maximum capacity at 30° slope, m^3/h			Maximum height at 30° slope, m		
		1-flight	2-flight	3-flight	1-flight	2-flight	3-flight
0.30	110	34	42	52	2.4	2.2	2.1
0.41	91	66	83	103	2.9	2.7	2.5
0.51	79	112	140	175	3.4	3.0	3.0
0.61	70	168	210	262	4.0	3.7	3.7
0.76	60	288	360	451	4.2	3.9	3.7
0.91	53	434	542	678	4.8	4.4	4.2
1.07	48	621	776	970	5.3	5.0	4.6
1.22	44	881	1,101	1,376	4.7	4.3	4.1
1.37	41	1,132	1,415	1,769	5.6	5.2	4.9
1.52	38	1,486	1,858	2,322	5.2	4.7	4.4
1.68	35	1,774	2,216	2,771	5.9	5.5	5.1
1.83	33	2,230	2,788	3,484	5.6	5.1	4.7
2.03	31	2,791	3,488	4,360	5.1	4.6	4.3
2.13	30	3,219	4,023	5,029	5.8	5.3	4.9

Q.2(b)	Examine the advantages and disadvantages of different types of bar screens.	[5]	2	3
Q.3(a)	With the help of a neat diagram elaborate an ASP.	[5]	3	4
Q.3(b)	A town has been directed to upgrade its primary WWTP to a secondary plant that can meet an effluent standard of 30.0 mg/L BOD_5 and 30.0 mg/L total suspended solids (TSS). They have selected a completely mixed activated sludge system. Assuming that the BOD_5 of the TSS may be estimated as equal to 60% of the TSS concentration, estimate the required volume of the aeration tank. The following data are available from the existing primary plant. *Existing primary plant effluent characteristics* Flow = 13,000 m^3/d BOD_5 = 80.0 mg/L Assume the following values for the growth constants: Ks = 100 mg/L BOD_5 ; μm = 2.5 d^{-1}; kd = 0.05 d^{-1}; Y = 0.50 mg VSS/mg BOD_5 removed. Also assume that the secondary clarifier can produce an effluent with 30.0 mg/L TSS, and that MLVSS = 2,000 mg/L.	[5]	3	5
Q.4(a)	Explain the process of anaerobic wastewater treatment.	[5]	4	2
Q.4(b)	Compare the attached and suspended anaerobic wastewater treatment processes.	[5]	4	4
Q.5(a)	Summarize the various thickening methods for sludge management in STPs.	[5]	5	5
Q.5(b)	Explain the process of alkaline stabilization for the management of solids in STPs.	[5]	5	2

::::::24/04/2023::::::E