Reg.No.					
0					



## MANIPAL UNIVERSITY Second Semester M.Tech. (IPC) SUBJECT: Industrial Wastewater Engineering (CHE 557) MAKEUP EXAMINATION – Jan 2016



## Time : 3 hrs

Max Marks: 100

- Answer any FIVE full questions and all questions carry equal marks.
- Missing data, if any, may be assumed suitably.

1A	The wastewater has a BOD <sub>5</sub> equal to 180 mg/l and a reaction rate k equal to 0.22/day. It											
	also has a Total Kjeldahl Nitrogen content (TKN) of 30 mg/l.											
	(i)Find the ultimate carbonaceous oxygen demand (CBOD)											
	(11)Find the	ultimate nitrogenous	oxygen demand	(NBOD)								
	(111)Find the remaining BOD after 5 days have elapsed.											
1 <b>D</b>	Describe the levels of westervator treatment and closely the treatment are seen											
ID	Describe the level of advancement?											
							(00)					
1C	Laboratory test reactors have been operated at different SRT values at a steady state to											
IC	obtain biolo	ogical kinetic coeffi	cient for a wast	ewater with sol	uble constituents	only.						
	The reactor	s are complete mixe	ed type and aera	ted systems. Th	e influent and eff	fluent						
	soluble CO	D and reactor MLVS	S concentrations	s are summarized	d as follows.							
	Test No	SRT	$S_0$	S	Х							
		days	mg COD/l	mg COD/l	mg VSS/l							
	1	3.1	400	10	3950							
	2	2.1	400	14.3	2865							
	3	1.6	400	21	2100							
	4	0.8	400	49.5	1050							
	5	0.6	400	101.6	660							
	From these results determine the values for blokinetic constants $\kappa$ , $\kappa_s$ , $\mu_{max}$ , Y and $\kappa_d$											
2A	Explain the	following terminolo	gies:									
	(i)Hydraulio	e retention time (ii)F	low through velo	ocity (ii)Surface	loading rate							
	(iv)Solid ret	tention time (v)S	ettling velocity									
			-				(05)					

2B	The data of wastewater generated by a community on an hourly basis is recorded as											S			
	shown in table below. Determine the volume of an equalization tank for the treatment											t			
	plant														
	Time(hr	) 1	2	3	4	5	6	7	8	9	10	11	12		
	Flow $(3)$	2.0	7.2	7.5	6.7	8.3	9.3	20.0	25.0	31.0	27.5	24.0	) 20.0		(15)
	(m /min	1)	1.4	15	16	17	10	10	20	21	22	22	24	_	
	Time(ni	$\frac{1}{210}$	14	15	10	1/	18	19	20	21 55	22 4 5	25	24	-	
	fi0W $(m^3/min)$	21.0	19.0	15.0	10.0	0.5	/.0	1.2	0.8	5.5	4.5	3.5	5.0		
		IJ													
3A.	A conventional activated sludge process plant is in operation with a $\theta_c$ of 10 days.														
	Reactor volume = $8000 \text{ m}^3$ , MLSS = $3000 \text{ mg/l}$ .														
	Determine														
	(i)Sludge	product	ion rate	•											
	(ii)Sludg	e wastag	e flow i	rate wl	nen wa	isting	from	the rea	actor						
	(111)Sludg	ge wastag	ge flow	rate w	hen w	asting	from	the re	ecycle I	ine.	0	/1			(10)
2D	Assume of Eastimate	the diam		suspe	nded s	for	in the	e recyc	iomy no	$\frac{1000}{1000}$	$\frac{10 \text{ mg}}{2.2 \text{ dg}}$	1	amitiaa	1	(10)
Э <b>D</b> .	detention	time for	which	the tre	D/u	L IOI	a sille Ite or	a $a$	n belov	nu ior	2.2 Uð period	of Q	bre	.1	
	Time	1	2 winch			51 1051			5	$\frac{101 a}{7}$		019	<u>0</u>	٦	
	(hr)	1	2	5	4	r	5		J	/	0		7		
	Conc	43	43.5	45	4	65	48	4	51	47	46		45.4		
	(mg/l)	15	13.5	15		0.5	10		<b>J</b> 1	17			13.1		
	Use both	variance	metho	d and	peak ti	ime te	chnio	ue.							(10)
	ese sour variance method and peak time teeninque.														
4A.	. Explain the major problems in ASP treatment systems.														
	I STREET STREET STREET													(5)	
4D													-		
4D.	following	i Hickilli i data Ce	ig miei alculate	the co	s all el	npine	ar me v valu		$\frac{1}{1000}$	l ellsta kenfeld	ler equ	luarus		e	
	Data give	g uata. Co en are	aiculat		mesp	Juang	z valu		f III LC.	Kennen	iei equ	auon	l <b>.</b>		
	Sewage flow = 5000 m <sup>3</sup> /day Raw ROD <sub>5</sub> = 200 mg/l Efficiency - 85% n - 0.5														
	Depth = $1.8 \text{ m}$ .													(8)	
	Assume FLR as 1.2 kg BOD/m <sup>3</sup> .day														
4C.	. Design an extended aeration lagoon to operate as Inter-Air system serving 4000 persons										s				
	using appropriate parameters. Assume $BOD_5 = 50$ g/person.day and average flow of Q										2	(7)			
	= 150 l/person.day. Neglect nitrification and denitrification. Take F/M ratio as 0.1 kg											g			
	BOD <sub>5</sub> /kg	MLSS													
5A	Explain any two types of high rate anaerobic reactors with a neat flow diagram?												(6)		
011.													(0)		
5B.	. Compute the aeration tank volume, oxygen requirements for a combined stage of											f			
	carbon-removal process and nitrification system for ammonia removal efficiency of											f			
	95%. Flow rate is 20 MLD. Influent BOD Concentration $S_0 = 200 \text{ mg/l}$ , Influent [TKN] <sub>0</sub>											0			
	$= 20 \text{ mg/l}$ , Effluent BOD concentration $S_e = 10 \text{ mg/l}$ , $k_d = 0.05 \text{ day}^{-1}$ , $k = 0.04 \text{ l/mg.day}$ ,											,			
	$Y_{\rm T} = 0.5$ ,	(µmax) <sub>N</sub>	s = 0.5	2 day	<sup>1</sup> . Wha	at are	the m	erits c	of comb	ined st	age op	perati	on when	n	(14)
	compared with separate system?														

6A.	What is sludge digestion? Explain the principal methods of processing and disposal of	
	sludge?	(5)
6B.	Explain stabilization pond as a low cost treatment system. List their merits and	
	drawbacks of the system.	(7)
6C.	Explain the disinfection process for wastewater treatment and compare the advantages and disadvantages of using chlorine, ozone and UV for wastewater disinfection.	(8)