Reg.No.	
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MANIPAL UNIVERSITY

Second Semester M.Tech.(Chemical Engineering)

END SEMESTER EXAMINATION – MAY 2017

SUBJECT: INDUSTRIAL WASTEWATER ENGINEERING (CHE 5235)

Date: 27/04/2017			Time : 3 hrs Max 2						Aarks: 100		
	• Ans	swer all	questio	ns.							
	 Mis 	ssing da	ita, if an	y, may	be assur	med su	itably.				
1A.	Derive t	he follo	wing:								(4+3=7 marks)
	(i) An ex	pressio	n for par	ticle se	ttling vel	locity f	or type 1	l settling	5.		
	(ii) Iwasaki equation for filtration.										
1 B .	Explain	the follo	owing:								(6+5=11
	(i) Mech	anisms	of coagu	lation a	and floce	ulation	with su	itable ex	ample.		marks)
	(ii) Worl	king of s	spiral wo	ound me	embrane	with a	neat ske	etch.			
1C.	List any	4 applic	cations o	f ion ex	change 1	resins.					(2 marks)
2A.	The effl	uent fro	om leath	er tanr	ning indu	ustry h	as the f	followin	g chara	cteristics:	
	COD: 1'	75 kg; l	BOD: 69	9 kg; S	uspended	d solid	s: 125 k	$xg; Cr^{3+}:$	6 kg;	$S^{2-}: 6 \text{ kg.}$	
	How wi	ll you d	lesign ar	n efflue	nt treatn	nent pla	ant to tr	eat the	above n	nentioned	
	wastewa	iter?									(10 marks)
2B.	What are	e the ma	ior prob	lems en	countere	ed in A	SP syste	ms?			(4 marks)
2C.	Estimate	the dia	spersion	numbe	er D/uL	for a s	small te	rtiary po	ond for	2.2 days	(6 marks)
	theoretic	al deter	ntion tim	e for w	hich the	tracer	test resu	ilts are g	given be	low for a	×
	period of	f 9 hrs.						c c	, ,		
	Time	1	2	3	4	5	6	7	8	9	
	(hr)										
	Conc	43	43.5	45	46.5	48	51	47	46	45.4	
	(mg/l)										
	Use both	n variano	ce metho	od and p	eak time	e techni	que.				
3A.	Explain	Anaerol	bic Cont	act proc	cess and	UASB	with a n	eat flow	diagram	n?	(6 marks)
3B.	B. Design a biodisc (Rotating biological contactor) for 600 persons to remove 90%										
	of the B	OD of	170 mg/	l at the	rate of	160 lpc	d.Assur	ne loadi	ng rate	as 10 gm	
	/m ³ .day	and vol	lume of	the tan	k as 40	m^3 . M	lake the	necessa	ry chec	k for the	
	efficiency using K_{a} as 2.3.									(10 marks)	
			u								
3C.	Show w	ith a flo	ow diagr	am the	combin	ed proc	cess of s	secondar	y treatr	nent with	
	contact filtration, carbon adsorption and reverse osmosis									(4 marks)	
4A.	A munic	cipal wa	istewatei	having	g a BOD) of 25	0 g/m^3	is to be	treated	by a two	
	stage trickling filter. The desired effluent quality is 25 g/m ³ of BOD. If both of										
	the filter depth are to be 1.83 m and the recirculation ratio is 2:1.Find the										
	required trickling filter diameter. Data are given below:										
	Flow rate = 7570 m ³ /day, Wastewater temperature = 20°C and $E_1 = E_2$							(8 marks)			

4B.	A conventional activated sludge process plant is in operation with a θ_0 of 10									
	days. Reactor volume = 8000 m^3 , MLSS = 3000 mg/l .									
	Determine									
	(i)Sludge pro	duction rate								
	(ii)Sludge wa	e wastage flow rate when wasting from the reactor								
	(iii)Sludge wa									
	Assume conc	(6 marks)								
4C.	Explain stabi									
	drawbacks of	lrawbacks of the system.								
5.	Write short n									
	(i)									
	(ii)									
	(iii)	(5*/								
	(iv)	Mechanism of photo-catalysis with a neat sketch	$(3^{+}4^{-})$ 20 marks)							
			,							
	(v)	Adsorption mechanisms with a pictorial representation								