Form A: Paper –Setting Blank

Ref No.: Ex/PG/CE/T/1210C/2018

M.E. CIVIL ENGINEERING 1st YEAR 2nd SEMESTER EXAMINATION, 2018

(~~1st~~ / 2nd Semester / ~~Repeat~~ / ~~Supplementary~~ / ~~Annual~~ / ~~Biannual~~)

SUBJECT: HAZARDOUS WASTE MANAGEMENT

(Name in full)

Full Marks: 100

Time: ~~Two hours~~/Three hours/~~Four hours~~/ ~~Six hours~~ (60 marks for this part)

Use a separate Answer-Script for each part

No. of Question	Part-I	Marks
	Answer Question-1 and any *two* from the rest	
Q.1) a)	Deduce the expression for determining **"Depth of Column (Z)"** for an **Air Stripping Column.**	(7)
b)	Explain with necessary reactions the steps involved in **destruction of cyanide by chlorine.**	(6)
c)	Explain with the help of appropriate example the process of **cometabolism** in the context of **biodegradation of xenobiotic compounds.**	(6)
d)	Deduce the necessary expression for estimating the bulk feed concentration (C_f) for **"Ultrafiltration"** process operating under **batch mode.**	(6)
e)	What do you mean by concentration polarization in the context of ultrafiltration and how is it controlled?	(3)
Q.2) a)	In an industrial zone the groundwater aquifer is found to be contaminated with chloroform. The maximum concentration of chloroform was found to be **1.34mg/L** which is to be reduced to **30µg/L** by an appropriately designed air stripping column. The following data are available: i. Overall transfer rate constant (K_La)= **0.0128/sec** ii. Liquid flow rate (Q_w)=**6.83 lt/sec** iii. Temperature=**26°C** iv. Henry's Law Constant (H)=**$6.37*10^{-3}$(atm.m^3/gm.mol)** v. Column Diameter=**0.7m** vi. Air to Water Ratio (Q_A/Q_W)=**21** **Determine the following:** i. Liquid Loading Rate (L) ii. Stripping Factor (R) iii. Height of Transfer Unit (HTU) iv. Number of Transfer Unit (NTU) v. Height of packing in column	(4+4+4+4)

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No. of Question	Part-I	Marks
Q.3) a)	What are the important considerations to be made while designing for dosage of a chemical oxidant?	(5)
b)	A semiconductor effluent contains **82.9Kg** of cyanide per day. Determine the stoichiometric amounts of **chlorine (Cl_2)** and **caustic soda (NaOH)** required for: i. **Oxidation of Cyanide to Cyanate** ii. **Oxidation of Cyanide to Nitrogen** Disregard the NaOH requirement for maintaining a pH of 10.0.	(5+6)
Q.4) a)	What are the essential components of an improved version of Land Treatment?	(5)
b)	Grab samples were taken from a test plot of **120ft*60ft** of a land farming site and analyzed for waste oil content on mass basis. The samples were reported to be collected from upper **5 inches** of the zone of incorporation (ZOI) and the sampling occurred just over **372 days** after initial application. The arithmetic mean value of waste oil content was observed as **12.55%.** What are the half life and degradation rate constant for the waste oil? Assume a soil density of **92.5 lb/ft^3** and an oil density of **1995 lb/T**. The date of application and the amount of waste applied to the plot receiving the waste oil are shown below:	(11)

Time of application (days after initial application)	Amount of Waste Oil applied (Tons)	Waste Oil concentration of applied waste (%)
0	21.7	13.3
102	31.7	14.7
237	28.2	15.1
303	24.9	16.8

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Hazardous Waste Management

e: Three Hours

Full Marks: 100

(60 marks for Part I & **40 marks for Part II**)

Use separate Answer-Scripts for each part

Part-II

Answer **Question No. 1** and any **Two** from the rest. Any relevant data may be assumed, if necessary.

Answer following questions very briefly:

a) Name the current Indian Hazardous Waste (HW) Rule.

b) What is the most preferred option in Waste Management Hierarchy?

c) What is the basic difference between risk and hazard? d) What is the first step of risk assessment?

e) Which is generally more, 'flash point' or 'fire point'? f) What is a reactive waste?

g) Correlate Hazard Identification and site history. h) What is the main objective of exposure assessment?

i) Give example of a situation when lethal concentration (LC) is to be found out instead of lethal dose (LD).

j) What is the identifying character other than pH to indicate a waste as 'corrosive'?

k) Define bio-concentration. l) Mention the rough toxicity threshold of LD_{50} value.

m) Define 'disposal' as per relevant Indian HW rule. n) Who is an 'occupier' as per relevant Indian HW rule?

o) What is 'transboundary movement' of HW? p) What is the threshold value of attributable risk?

q) Write full form of IARC & RCRA r) What is a 'group 1' carcinogen?

s) 'Potency factor of chloroform (oral route) is 6.1×10^{-3} $(mg/kg\text{-}day)^{-1}$'-explain the statement.

t) 'Bioconcentration factor of TCE is 10.6L/kg' – explain the statement. 1X20=**20**

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Hazardous Waste Management

Time: Three Hours

Full Mark

(60 marks for Part I & **40 marks for Part II**)

Use separate Answer-Scripts for each part

Part-II

2. a) What is toxic waste ? What is the difference between hazardous waste and toxic waste? What is LI

b) A toxicity study on the resistance of mice to a new pesticide has been conducted with the followin results: What is LD_{50} of this pesticide for mouse (20gm)? What may be the LD_{50} for a standard mai

Dose (mg/kg)	% mortality
0	0
2.5	10
5.0	20
7.5	30
10.0	40
12.5	60
15.0	70
17.5	90
20.0	100

4+6=**10**

3. a) What is the significance of 'politically acceptable risk'? What is DWEL? How is it related with potenc factor?

b) Compute the DWEL for methylene chloride.

c) If the DWEL of a contaminant is 15 ppb, what potency would produce this value? 3+4+3=**10**

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Time: Three Hours

Full Marks: 100

4. a) For a person eating locally caught fish, estimate the lifetime cancer risk from fish taken from waters containing a concentration of TCE equal to 150ppb.

b) What are the best and worst options of risk management as per hierarchy of control measures?

c) What is the basic difference between risk assessment and risk characterization? 5+3+2=10

Some of the following information may be needed:

i) **Table A**

Chemical	PF(oral) $(mg/kg\text{-}day)^{-1}$	PF(inhalation) $(mg/kg\text{-}day)^{-1}$	Oral RfD (mg/kg-day)	BCF (L/kg)
Chloroform	6.1×10^{-3}	8.1×10^{-2}	0.010	3.75
Trichloroethylene (TCE)	1.1×10^{-2}	1.3×10^{-2}	0.0005	10.6
Tetrachloroethylene	5.1×10^{-2}	$1\text{-}3.3\times10^{-3}$	0.10	31.0
Benzo(a)pyrene (BaP)	11.5	6.11	0.0002	------
Methylene chloride	7.5×10^{-3}	1.4×10^{-2}	0.060	------

ii) **Table B**

Exposure pathway	Daily Intake	exposure frequency (days/yr)	exposure Duration (yrs)	body wt. (kg)
Ingestion of potable water	2 L	350	30	70
Inhalation of contaminant	20 m^3	350	30	70
Consumption of fish	54 gm	350	30	70