M.E. (Water Resources & Hydraulic Engineering) Examination (Evening), 2018

(1st Year-2nd Semester)

AQUATIC ECOLOGY AND ENVIRONMENT

Time : Three Hours Full Marks : 100

Answer any ***four*** questions.

1. (a) Estimate the overall chemical composition of a solid-waste. Derive an approximate chemical formula for the organic portion of a solid waste sample with the composition given in Table.

(b) Determine the moisture content of a 175 kg solid waste sample. Composition given in Table.

(c) What is Stationary container system of municipal solid waste collection system? Explain in details.

(d) What is *modified Dulong formula*.

(15+4+4+2)

2.(a) A waste water treatment plant discharges to a small stream, the characteristics of the stream are given below

	Stream	**Wastewater**
Flow	0.5 m^3/d	1500 m^3/d
BOD	2.2 mg/L	-
DO	85% saturation	0 mg/L
Temp.	24 °C	21°C
	K_r=0.45 day^{-1}	K_d=0.23 day^{-}

Determine the maximum BOD_5 at 20°C that can be discharged if a minimum of 4.2 mg/L of O_2 must be maintained in the stream.

Take Saturation DO at 21^0C= 8.9 mg/L

(b) Deduce an expression mathematically of oxygen deficit after time 't' and also find out the oxygen level and time in the stream at which the maximum deficit occurs.

3.(a) Give a Schematic Diagram for Global Heat Energy and Average Energy Flow in case of short and long wave side.

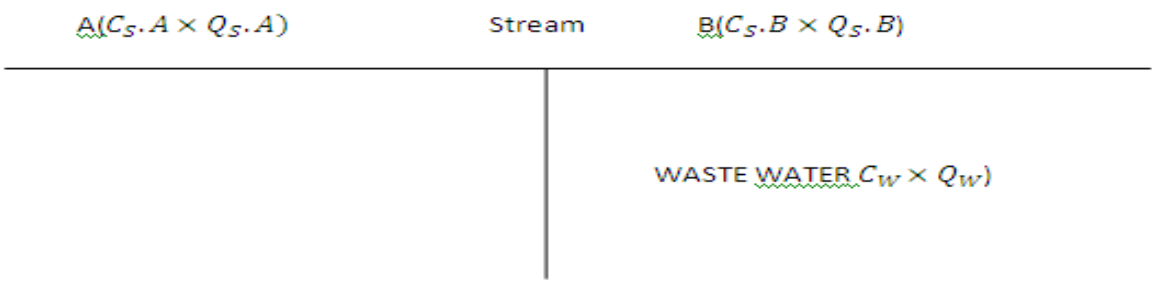
(b) Estimate the quantity of carbon (in G-t) in global atmosphere corresponding to a concentration of 2 ppm_v of CO_2. Assume that total mass of air equals to 8.3×10^{19} gm. The density of air at 15°C and 2 atmospheric pressure is 2.78 kg/ m^3. Average global CO_2 concentration is 364 ppm as per IPCC in 1994.

(c) (i) What is DBU?

(ii) How much exposure time will be needed when a man doing some physical activity (α=3) is exposed if the ratio of CO and O_2 in the blood is found to be 1:12 for the CO in air breath is 120 ppm?Assume O_2 content of air breathed = 24* 10^5 ppm and constant, M = 240.

$(7\frac{1}{2}+10+2\frac{1}{2}+5)=25$

4. (a) A treated waste water enters a stream as shown in the accompanying figure. The concentration of sodium in the stream at point A is 25 mg/L and the flow rate is 55 m^3/s. The concentration of sodium in the waste stream is 250 mg/L and flow rate is 3.0 m^3/s. Determine the concentration of sodium at point B. Assuming that complete mixing has occurred.



(b) Classify the different types of waste products.

(c) Define Natural self-purification of streams and discuss different types of self-purification of stream.

(d) (i) The BOD_5 of a waste has been measured as 700 mg/L. If K_d= 0.22/day (base e), what is the ultimate BOD_u of the waste. What proportion of the BOD_u would remain un-oxidized after 25 days.

(ii) The following observations were made on a 4% dilution of wastewater.

Dissolved oxygen (D.O.) of aerated water used for dilution = 3.5 mg/L
Dissolved oxygen (D.O) of diluted sample after 5 days incubation = 0.9 mg/L
Dissolved oxygen (D.O) of original sample= 0.7 mg/L

Calculate the BOD of 5 days and ultimate BOD of the sample assuming that the de-oxygenation coefficient is 0.17 (base e).

(4+4+5+(6+6)) = 25

5.(a) What are the major sources of river pollution in India ?

(b) Highlight the basic principle of waste water treatment in Waste Stabilization Pond.

(c) How risk of odour problem in anaerobic pond can be avoided?

(d) It is proposed to construct Waste Stabilization Ponds to treat domestic waste water generating from a small town. Following information is available:

Design Population of the Town: 50000; Per capita sewage flow: 100 lpcd Waste water characteristics: BOD = 106 mg/l, COD = 228 mg/l, pH = 7.2, Suspended Solids = 115 mg/l, T.C. = 90000000/100 ml F.C. = 5000000/100 ml, Solar Radiation: Winter- Max = 170

cal/sq.cm/day, Min = 110 cal/sq.cm/day. Summer- Max = 280 cal/sq.cm/day, Min = 140 cal/sq.cm/day, SCF = 0.7, Temp (winter) = 200C, Temp (summer) = 25^0C, Kp_{20} = 0.12/day

Design the Anaerobic Pond, Facultative Pond and Maturation Pond (Calculate the sizes) (For Maturation Pond design consider average winter temp of waste water as 24^0C and average ambient temp as 18^0C. Heat Exchange Co-efficient = 0.49 m/day)
Draw flow diagram of the waste water treatment plant.

(Assume any other design data when required)

2+4+3+16

6. (a) Briefly highlight aims and objectives of "Environmental Impact Assessment"

(b)What are the important steps in the EIA with EMP Process to be followed?

(c) What are the environmental components of EIA?

8+10+7=25

7. Write short notes on the following (any two):
   (i) 'Landfill' land disposal technique of hazardous waste.
   (ii) Major sources of river pollution
   (iii) Nitrogen Cycle
   (iv) Effect of CO on human health
   (v) Caron Cycle

(10x2=25)