UNIVERSITY OF MINES AND TECHNOLOGY, TARKWA

SECOND SEMESTER EXAMINATIONS, MAY 2019

COURSE NO: **ES 378**
COURSE NAME: **ENVIRONMENTAL MODELLING**
CLASS: **ES 3** **TIME**: **3 HOURS**

Name**:** _____Index Number: _____

Attempt all questions

1. a. What is BOD? **[1 MARKS]**

   b. Briefly describe the zones of self-purification of streams

   [6 MARKS]

   c. Identify 3 effects each of the following

   i. Eutrophication

   ii. High Turbidity

   [3 MARKS]

   d. A wastewater of flow 5.0 m^3/sec is discharged into a river of flow 50 m^3/sec. The ultimate BOD of wastewater is 200 mg/l and DO is 1.5 mg/l. The river water has a BOD of 3 mg/l and DO of 7 mg/l. The reaeration coefficient of the river water is 0.2/day and BOD decay coefficient is 0.4/ day. The river has a cross-sectional area of 200 m^2 and the initial oxygen deficit of the stream is 1.5 mg/l. **[Note: use k to the base 10]**

   i. At a downstream point of 10 km calculate the DO of the mixture.

   ii. At which point the DO is a bare minimum

   [10 MARKS]

2. a. Water samples of mine A were sent to Lab B. As the Environmental and Safety Manager of Mine A, you doubt the credibility of the sample results based on some pattern of figures received. Verify the credibility of the sample results shown in the table below if the acceptable error is pegged at 5% and comment on the results **[9 MARKS]**

b. Qualify the water's aptitude for irrigation using sodium percentage and sodium adsorption ratio based on the results below **[6 MARKS]**

Parameters	Concentration(mg/l)
Ca^{2+}	93.8
Fe^{2+}	6
Mg^{2+}	28.0
Na^{+}	13.7
HCO_3^{-}	164.7
SO_4^{2-}	134.0
Cl^{-}	92.5
K^{+}	30.2
Cu^{2+}	23
Mn^{2+}	4

SODIUM ADSORPTION RATIO WATER CLASS

SAR VALUE	TYPE OF WATER	WATER QUALITY
0-10	Low sodium water	Excellent
10–18	Medium sodium water	Good
18-26	High sodium water	Fair
Above 26	Very high sodium water	Poor

SODIUM PERCENT WATER CLASS

SODIUM (%)	WATER CLASS
< 20	Excellent
20-40	Good
40-60	Permissible
60-80	Doubtful
> 80	Unsuitable

3. a. Identify 5 gaseous pollutants **[2.5 MARKS]**

   b. State 2 effects each of any 3 of the pollutants identified in a **[3 MARKS]**

   c. Identify 5 factors that determine the harmfulness of particulates **[2.5 MARKS]**

4. a. A proposed processing plant is expected to emit 110g/s of H_2S from a single stack of height 80m. The nearest receptor is a small town 100m from the site. The southwest winds are expected to move at a rate of 5m/s which will cause the plume to rise to a height of 20m. What is the pollution concentration at ground level at the start of the town. Assume stability class D so σ_y= 126 m and σ_z= 51 m (Take y= 100m and z= 120m) **[10 MARKS]**

   b. An industrial plant is proposed for location on a stream. The industry would discharge wastewater containing 1300mg/l of total dissolved solids (TDS) at a rate of $3m^3/s$. The receiving stream has an average velocity of 0.5m/s, an average width of 15m, and an average depth of 0.6m with a TDS concentration of 310mg/l.

   i. Will this proposed plant discharge result in violation of the EPA standards (assumed to be 500mg/l)?

   ii. What is the level of impact?

[7 MARKS]

Examiner: Dr Ishmael Quaicoe