Registration No:

Total Number of Pages: 02   **M.Tech.**
                                                                                P1ESBC05

1st Semester Regular / Back Examination 2017-18
ENVIRONMENTAL CHEMISTRY AND MICROBIOLOGY
BRANCH: ENVIORN ENGG., ENVIRONMENTAL SCIENCE AND ENGG
Time: 3 Hours
Max Marks: 100
Q.CODE: B1075
Answer Question No.1 is compulsory and any four from the rest.
The figures in the right hand margin indicate marks.

Q1   **Answer the following questions:** *Short answer type*   **(2x10)**
   a)   What happens to the atomic number and mass number of daughter element as compared to the parent element as a result of α emission?
   b)   What is a zero order reaction?
   c)   Show how free energy change determines whether a chemical reaction will be spontaneous or not.
   d)   Why do we balance a chemical equation?
   e)   What is Avogadro's number?
   f)   Give the valencies of Na, Ca, Cl and O.
   g)   Define the equivalent conductance of an electrolyte.
   h)   What is half life period of a chemical reaction?
   i)   Give two modes of shifting the chemical equilibrium.
   j)   Write the Nernst equation for emf of a cell.

Q2 **a)** Define Boyle's law, Charles' law andAvogadro's law and derive the universal gas equation based on them. Determine the weight in grams of oxygen contained in a 10 litre container at 5 atmosphere pressure and 0° C temperature (R= 0.0821 L.atm/mol. K).   **(10)**

   b) Define Henry's law and Roult's law. Benzene, toluene, ethyl benzene and xylene are common constituents of gasoline. The vapour pressures of the pure liquids are, respectively, 0.126, 0.0380, 0.0126 and 0.0117 atm at 25 ^{o}C. Assuming an equimolar mixture of these liquids obeys Roult's law; calculate the vapour pressure exerted by each chemical and the total vapour pressure exerted by the mixture.   **(10)**

Q3 **a)** Define internal energy, enthalpy, entropy and free energy associated with a chemical equation. Show their interrelationship. Based on change in entropy and change in free energy values how do you conclude whether a reaction will be favorable in that direction or not.   **(10)**

   b) Calculate the approximate rise in solution temperature if 2 L of 1N H_2SO_4 is mixed with 2 L of 1N NaOH. $(\Delta H^{\circ}_{(H_2SO_4)}(aq) = -909.3 \frac{kJ}{mol}, \Delta H^{\circ}_{(NaOH)}(aq) = -470.1 \frac{kJ}{mol}, \Delta H^{\circ}_{(Na_2SO_4)}(aq) = 1385.5 \frac{kJ}{mol}, \Delta H^{\circ}_{(H_2O)}(l) = -285.8 \text{ kJ/mol})$ **(10)**

Q4 **a)** Briefly discuss about various water borne diseases and their control measures. **(10)**
   b) Briefly discuss about the various microorganisms likely to be present in water and Wastewater and their effects on human health.   **(10)**

Q5 **a)** Define atomic weight, molecular weight, equivalent weight and valency of elements and compounds. How do you calculate the equivalent weight of acids, bases, salts and oxidizing agents?   **(10)**

b) Discuss about the different modes of expressing concentration of an aqueous solution. A water sample contains 44 mg/L of calcium ion and 19 mg/L of magnesium ion. What is the hardness expressed as mg/L of CaCO3? Note that hardness is the sum of the multivalent cations. (Eq. Wt. of Ca^{2+}=20, Mg^{2+}= 12 and $CaCO_3$= 50). **(10)**

Q6 **a)** Balance the following chemical equations: **(10)**
(i) $KMNO_4 + H_2SO_4 + Zn \rightarrow K_2SO_4 + MnSO_4 + ZnSO_4 + H_2O$
(ii) $HNO_3 + Cu \rightarrow CuNO_3 + NO_2 + H_2O$

b) Define acids and bases according to Arrhenius theory. Discuss their ionization. What is ionic product of water and how would you arrive at pH from this concept? **(10)**

Q7 **a)** Give an account of the disinfecting action of chlorine. **(10)**
b) Discuss about break point chlorination with a neat sketch. **(10)**