B.Sc. Engg. CSE 2nd Semester 31 October 2019

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
Department of Computer Science and Engineering (CSE)

SEMESTER FINAL EXAMINATION SUMMER SEMESTER, 2018-2019
DURATION: 3 Hours FULL MARKS:150

Chem 4241: Chemistry

Programmable calculators are not allowed. Do not write anything on the question paper.
There are **8 (eight)** questions. Answer any **6 (six)** of them.
Figures in the right margin indicate marks.

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1. a) Name and define Chemical bonds. Give a comparative picture of Ionic and CovalentCompounds. 8
   b) Draw the molecular diagram of NO and CN and explain the bond order and magnetic properties of them. 10
   c) Define hydrogen bond and metallic bonds. Briefly describe their effect with suitable examples. 7

2. a) Define chemical potential and Gibb's free energy. 6
   b) Derive a mathematical equation relating the free energy change (ΔG) and Equilibrium constant (K). Mention the significance of the obtained equation. 12
   c) Calculate Kp for the reaction $N_2(g) + O_2(g) \leftrightarrow 2NO(g)$ at 25^0C, when the value of standard free energy (ΔG^0) is 173 KJ. Comment on the result. 7

3. a) Explain Le Chatelier's principle and show the effect of pressure and catalyst on a gaseous system at equilibrium. 8
   b) Derive the expression of Kp and Kc for the reaction $N_2(g) + 3H_2(g) \leftrightarrow 2NH_3(g)$ in terms of "a", "b" and "x" where "a" and "b" are the initial number of moles of the reactants and "x" is the number of moles going into reaction at equilibrium. Let "P" and "V" are the total pressure and volume of the system. Mention the significance the obtained expressions. 10
   c) For the reaction $PCl_5(g) \leftrightarrow PCl_3(g) + Cl_2(g)$, 35% $PCl_5(g)$ is dissociated at 373K. If the total pressure of the system at equilibrium is 1.5atm., calculate the value of Kp and Kc. 7

4. a) Define and classify conductance. What is an electrochemical cell? 5
   b) Draw and explain Galvanic cell. What is the composition and function of Salt bridge? 8
   c) Derive a mathematical equation showing the relationship between equilibrium constant and temperature. Give the graphical representation as well. 12

5. a) What is energy of activation(Ea)? Derive an equation showing the relationship temperature and rate constant (k). 10
   b) Derive the rate constant(k) for a Reversible reaction at equilibrium with diagram. 8
   c) The value of the half-life for a first order reaction is 1000 seconds. At what time 1/10th of the reactant will remain unreacted? 7

6. a) Define heat of reaction and heat of neutralization with suitable examples. 6
   b) Define heat capacities at constant volume and pressure. Derive mathematical equation showing the effect of temperature on the heat of reaction. 12
   c) The heat of reaction $1/2H_2 + 1/2Cl_2 \rightarrow HCl$ at 27°C is -22.1kcal. Calculate the heat of reaction at 77°C. The molar heat capacities at constant pressure and at 27°C for hydrogen, chlorine and HCl are 6.82, 7.70 and 6.80 cal/mol respectively. 7

7. a) Define modern periodic table. Classify elements in terms of electronic Configuration. 8
   b) Discuss the variation of properties of elements within periods and groups with reference to their (i) Ionization potential (ii) Electro negativity. (iii) Metallic character. 9
   c) What is the unit of equilibrium constant(K)? Derive the relationship between Kp and Kc and show it's application. 8

8. Write short notes on the following: 5×5
   i. Osmosis and Reverse Osmosis
   ii. Quantum Number
   iii. Hess's law of constant heat summation
   iv. Dry cell
   v. Differential and Isolation method in order determination