B.Sc. Engg. (CEE)/1st Sem. 11 October, 2023 (Morning)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

TERM: MID SEMESTER EXAMINATION
COURSE NO.: Chem - 4153
COURSE TITLE: Chemistry –1

WINTER SEMESTER: 2022-2023
TIME: 1.5 Hours
FULL MARKS: 75

There are **4 (Four)** questions. Answer **any 3 (Three)** questions. Do not write on this question paper. The figures in the right margin indicate full marks and corresponding CO and PO in the brackets. Symbols convey their usual meanings. Assume reasonable values for any missing data.

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1. **(a)** Write the names of different colligative properties. With suitable examples justify the reason for calling them colligative properties. State the laws of osmotic pressure and show that these are nothing but the gas laws. **(8.33) (CO2) (PO1)**

   (b) Point out the similarities and differences between molarity and normality of a solution? **(8.67) (CO1)**
   Discuss the effects of presence of a salt and nature of solute and solvent on the solubility of a solid in water. **(PO1)**

   (c) A saturated aqueous solution is prepared by mixing 17.1g sugar, 2.5g lemon juice and 180g water. If the mole fraction of sugar and water are 0.2 and 07 respectively then what will be the molecular weight of lemon juice? **(8.0) (CO1) (PO1)**

2. **(a)** Depending on the nature of liquid, classify liquid – liquid solution into different classes giving examples. Discuss the effect of pressure and presence of salt on the mutual miscibility of liquid – liquid solution. **(8.67) (CO1) (PO1)**

   (b) State and explain distribution law. Discuss the application and limitations of distribution law and point out its similarity with Henry's law. **(8.0) (CO1) (PO1)**

   (c) An aqueous solution is prepared by dissolving 0.9 gram glucose in 150 g solvent. If the freezing point of the solution is $-1.6^{o}C$, then what will be the value of crioscopic constant of the solvent? **(8.33) (CO2) (PO1)**

3. **(a)** What is phase rule? Why it is called Gibb's phase rule. Write the condensed form of Gibb's phase rule. Derive phase rule. **(8.33) (CO1) (PO1)**

   (b) Draw the phase diagram of CO_2 and describe its different characteristic parts using phase rule. **(8.33) (CO1) (PO1)**

   (c) What do you understand by semi-permeable membrane, osmotic pressure and osmosis? Discuss reverse osmosis with a suitable figure. Mention an important application of reverse osmosis. **(8.33) (CO2) (PO1)**

4. **(a)** Classify the solution of a solid in liquid into different classes. Describe the preparation of a super-saturated solution. Explain why a super-saturated solution of an exothermic solute cannot be prepared? **(8.33) (CO1) (PO1)**

(b) Derive a mathematical expression by which one can calculate the molecular weight of an unknown solute by measuring the vapour pressure of liquid. Which law is directly related to this derivation? state that law. **(8.33) (CO2) (PO1)**

(c) A solution is prepared by dissolving 1.3g of an unknown solute in 250.0g water. The vapour pressure of the solution and solvent at 40°C are 760 & 730 mm(Hg). Calculate the molality of the solution. **(8.33) (CO1) (PO1)**