B.Tech. (Sem. – 1ˢᵗ & 2ⁿᵈ)
ENGINEERING CHEMISTRY
SUBJECT CODE : CH – 101 (2004 – 2010 Batch)
Paper ID : [A0110]

Time : 03 Hours   **Maximum Marks : 60**

Instruction to Candidates:

1) Section - **A** is **Compulsory**.
2) Attempt any **Five** questions from Section - **B** & **C**.
3) Select atleast **Two** questions from Section - **B** & **C**.

Section - A

Q1)   *(2 Marks each)*

    a) Define R_f.

    b) IR spectra is often characterized as molecular finger prints. Explain.

    c) What is the cause of permanent hardness? Can it be removed by either boiling or addition of lime?

    d) Explain degree of hardness of water.

    e) Draw the acid-base conductometric titration curve of HCl vs NaOH.

    f) What is the difference between critical point and triple point?

    g) What is photosensitization?

    h) Rusting of iron is quicker in saline water or in ordinary water. Explain.

    i) State phase rule?

    j) What information is obtained from spin-spin splitting in NMR?

Section – B   (8 Marks each)

Q2) a) Calculate the quantity of lime and soda needed for softening 50,000 litres of water containing the following salts per litre: $Ca(HCO_3)_2$ = 8.1 mg; $Mg(HCO_3)_2$ = 7.5 mg ; $CaSO_4$ = 13.6 mg; $MgSO_4$ = 12.0 mg ; $MgCl_2$ = 2.0 mg and NaCl = 4.7 mg.

    b) Discuss chemical coagulants used for municipal water.

Q3) a) Explain cathodic protection.

    b) Discuss the use of corrosion inhibitors.

Q4) a) Why there is a need to develop the chromatogram? Discuss various methods that can be used for development / visualization.

    b) Give the classification of chromatography.

    c) Draw flow diagram of LC instrument.

Q5) a) Derive the Nernst equation for zinc rod in contact with a solution of Zn^{2+} ions.

    b) What are concentration cells? Discuss electrode concentration cells.

Section – C   **(8 Marks each)**

Q6) a) How photochemical reactions differ from thermal reactions? Discuss Stark- Einstein law of photochemical equivalence.

b) Differentiate fluorescence from phosphorescence.

Q7) a) Discuss theory of UV-visible spectroscopy.

b) Which will occur at a higher frequency:
   i) The C-N stretch of an amine or the C-N stretch of an amide?
   ii) The C-O stretch of phenol or the C-O stretch of cyclohexanol?
   iii) The C=O stretch of ketone or the C=O stretch of an amide?
   iv) The stretch or the bend of the C-O bond in ethanol?

Q8) a) Sketch the ^{1}H NMR spectrum, including multiplet patterns for each of the following compounds:
   i) CH_3CHBr_2
   ii) CH_3CH_2I

b) Discuss the information obtained from ^{13}C NMR spectrum.

Q9) a) What is degree of freedom?

b) Draw and discuss phase diagram of carbon dioxide.

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