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**B.Tech. (Sem. – 1<sup>st</sup> & 2<sup>nd</sup>)**

**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:  $\text{Ca}(\text{HCO}_3)_2 = 8.1 \text{ mg}$ ;  $\text{Mg}(\text{HCO}_3)_2 = 7.5 \text{ mg}$ ;  $\text{CaSO}_4 = 13.6 \text{ mg}$ ;  $\text{MgSO}_4 = 12.0 \text{ mg}$ ;  $\text{MgCl}_2 = 2.0 \text{ mg}$  and  $\text{NaCl} = 4.7 \text{ mg}$ .
- 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  $\text{Zn}^{2+}$  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  $^1\text{H}$  NMR spectrum, including multiplet patterns for each of the following compounds:  
i)  $\text{CH}_3\text{CHBr}_2$   
ii)  $\text{CH}_3\text{CH}_2\text{I}$   
b) Discuss the information obtained from  $^{13}\text{C}$  NMR spectrum.
- Q9)** a) What is degree of freedom?  
b) Draw and discuss phase diagram of carbon dioxide.

