(b) What is Electronegativity and how is it related to the ability of an atom to attract electrons in a chemical bond ? Can you explain the trends in electronegativity across the periodic table and discuss its implications for bond polarity and chemical reactivity ? **10**

6. (a) Explain crystal field theory and how it influences the energy level diagram of transition metals. Differentiate between the CFT diagrams of tetrahedral and octahedral molecules. **10**

(b) How does Benzene contribute to the unique properties of aromaticity ? **5**

7. What are the main types of organic reactions and how do they differ in terms of the changes they induce in molecular structure ? Provide examples of reactions involving substitution, addition, elimination, oxidation, reduction, cyclization, and ring openings. Outline the synthesis of paracetamol. **15**

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007202

May 2024

B.Tech. (EL/ECE/ENC/EEIOT/CSE(AIML))

(Second Semester)

Chemistry (BSC-102)

Time : 3 Hours] [*Maximum Marks : 75*

Note : It is compulsory to answer all the questions (1.5 marks each) of Part A in short. Answer any *four* questions from Part B in detail. Different sub-parts of a question are to be attempted adjacent to each other.

Part A

1. (a) How does ideal gas differ from real gas ? **1.5**

(b) What do you understand by Aromaticity ? **1.5**

(c) What is the concept of hard and soft acids and bases ? **1.5**

(d) What are electromagnetic radiations ? How they are related to spectroscopy ? **1.5**

(e) What do you understand by Polarity ? Write some examples of polar and non-polar compounds. 1.5

(f) How many NMR peaks do the following compounds show ? 1.5

HCl, CH_4, and CH_3CH_2Cl

(g) Discuss the Nernst equation and its application in predicting cell voltages. 1.5

(h) What is corrosion and how does it occur in Iron ? 1.5

(i) What is meant by an effective nuclear charge ? 1.5

(j) How is free energy related to electromotive force (emf) in electrochemical reactions ? 1.5

Part B

2. (a) Discuss the concept of entropy and free energy. What are the methods used for calculating entropy and free energy changes and their significance in predicting the feasibility of chemical reactions ? 10

(b) What is Chirality and how does it relate to the concept of optical activity in molecules ? 5

3. (a) Differentiate between fluorescence and phosphorescence using the Jablonski diagram. 8

(b) How does doping affect the band structure of solids ? Explain the role of dopants in altering the electronic properties of semiconductors. 8

4. What do you understand by the Ellingham diagram ? What information do they provide about the stability of metal oxides at different temperatures ? Explain, how free energy considerations influence the choice of metallurgical processes. Discuss its application in metallurgy. 15

5. (a) Discuss the pi-molecular orbital diagram of butadiene. 5