AS- 103 **Roll No.** | | | | | | | | | | |

B. Tech.
(SEM I) ODD SEMESTER EXAMINATION 2015-16
ENGINEERING CHEMISTRY

[Time: 3 hrs.] **[Max. Marks: 100]**

Note: Attempt **ALL** questions. Marks and number of parts to be attempted are mentioned in each question.
Attempt all parts of each question at one place.

1. Attempt any **TWO** parts of the following: **(2x10=20)**

(a) (i) What are stoichiometric and non-stoichiometric defects? Explain Frenkel and Schottky Defects found in solids.

(ii) Give the structure of graphite and explain its lubricating properties.

(b) (i) Draw the molecular orbital diagrams of NO and CO. Calculate their bond orders and explain why they shall be paramagnetic or diamagnetic?

(ii) The unit cell of an element of atomic mass 96 and density 10.3 g cm^{-3} is a cube with edge length of 314 pm. Find whether the structure of the crystal lattice is SC, BCC or FCC. (Avogadro's number is 6.023 X 10^{23} atoms $mole^{-1}$)

(c) (i) What are Nematic Liquid crystals? Discuss the applications of Liquid crystals.

(ii) Discuss the structure and applications of Fullerenes.

2. Attempt any **FOUR** parts of the following: **(4x5=20)**

(a) What are organometallic compounds? How will CH_3CH_2MgBr react with HCHO, CH_3CHO, $(CH_3)_2CO$ and CO_2?

(b) What is meant by Tacticity? With suitable examples, explain Isotactic, Syndiotactic and Atactic polymers.

(c) Differentiate between Chain Growth and Step Growth polymers.

(d) Discuss the preparation, properties and uses of PTFE and Butyl rubber.

(e) What are biodegradable polymers? Give the structures of starch and cellulose. Why can human beings digest starch but not cellulose?

(f) Give the mechanism of polymerization of styrene using benzoyl peroxide as an initiator. What effects will the presence of impurity of CCl_4 has on this polymerization process?

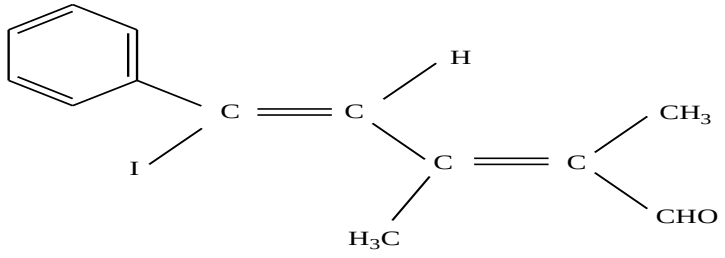
3. Attempt any **FOUR** parts of the following: **(4x5=20)**

(a) What is Atropisomerism? Giving appropriate examples, explain under what conditions atropisomerism is exhibited by any compound?

(b) Draw the energy profile diagram and comment on the stereochemistry for the following reaction:

$$(CH_3)_3CBr + OH^- \rightarrow (CH_3)_3COH + Br^-$$

(c) What is E- Z configuration? How is E- Z system of configuration assignment better than cis- trans configuration? Assign E or Z configuration to the following and predict how many stereo isomers are possible for the following compound?



(d) Draw all the possible stereoisomers for 1, 2 Dimethyl cyclopropane and 1, 3- Dimethyl cyclobutane. Comment on the optical activity of these stereoisomers. How many stereoisomers are possible for 2-Isopropyl-5-methylcyclohexanol?

(e) What is Saytzeff's rule? Predict the major and minor products obtained by base catalyzed 1, 2- elimination of 2- Bromobutane and 2-Bromo-2,3-dimethyl butane.

(f) What are anodic and cathodic metallic coatings? How is galvanizing and electroplating done to protect the metal against corrosion?

4. Attempt any **TWO** parts of the following: **(2x10=20)**

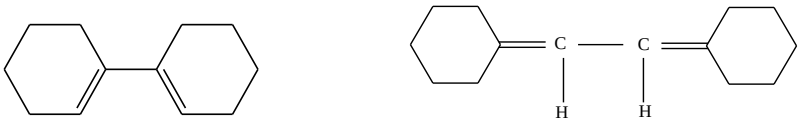
(a) Discuss the working principle of Zeolite process for softening of hard water. A zeolite softener was 90% exhausted by removing the hardness completely when 10,000 litres of hard water sample passed through it. The exhausted zeolite bed required 200 litres of 3% NaCl solution for its complete regeneration. Calculate the hardness of water solution in ppm.

(b) Explaining the terms involved, state the phase rule. Discuss the application of phase rule to water, vapor and ice system.

(c) Explain the process of reverse osmosis. A sample of water on its analysis gave the following constituents in mg/L: $Mg(HCO_3)_2$ = 73; $CaSO_4$ = 68; $MgCl_2$ = 95; $MgSO_4$ = 12; $Ca(HCO_3)_2$ = 81; NaCl = 6.8. Calculate the temporary and permanent hardness of the sample of water.

5. Attempt any **TWO** parts of the following: **(2x10=20)**

(a) (i) What are chromophores and auxochromes? How do auxochromes increase the coloring power of chromophores? Why the λ_{max} for the diene (I) is observed at a lower nm than (II) ?



(I) (II)

(ii) For XY_2 bent molecule show various types of stretching and bending vibrations in IR spectroscopy.

(b) Why is TMS used as an internal standard in NMR spectroscopy? Giving appropriate examples explain what are equivalent and non equivalent protons? A compound having molecular formula $C_9H_{11}Br$ gave the following set of ^1H NMR signals: δ 2.15 (2H, q); δ 2.75(2H, t); δ 3.38(2H, t) and δ 7.22 (5H, s)). Giving proper reasons suggest a structure consistent with the above data.

(c) Explain the stages involved in production of biogas from cattle dung. On burning 0.3g of a solid fuel in a bomb calorimeter, the temperature of 3500g of water increased from 26.5° to 29.2° C. Water equivalent of calorimeter and latent heat of steam are 385.0g and 587.0 cal/g respectively. If the fuel contains 0.7% hydrogen, calculate its gross and net calorific value.

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