



WEST BENGAL STATE UNIVERSITY  
B.Sc. Honours 1st Semester Examination, 2018

CEMACOR01T-CHEMISTRY (CC1)

ORGANIC CHEMISTRY-I



Time Allotted: 2 Hours

Full Marks: 40

*The figures in the margin indicate full marks.  
Candidates should answer in their own words and adhere to the word limit as practicable  
All symbols are of usual significance*

Answer **three** questions taking **one** from each Unit

**Unit-I**

1. (a) Calculate DBE for the molecule with molecular formula  $C_7H_8N_2$ . 1
- (b) Draw the orbital picture of  $CH_2=CH-CN$  and indicate the state of hybridisation of carbon and nitrogen in " $\pi$ "  $CN$ ". 2
- (c) Compare with reason the dipole moments of 2  
 $CH_2=CH-Cl$  (I)       $CH_2=CH_2Cl$  (II)      and       $CH\equiv C-Cl$  (III)
- (d) Draw the Frost mnemonic for the  $\pi$  MO's of square planar cyclobutadiene and hence calculate its delocalization energy in terms of  $\beta$ . 3
- (e) Draw all possible canonical forms of diazomethane  $CH_2N_2$  and justify which one is the most stable and which one is the least stable among them. 3
- (f) Classify the following species as nonaromatic, aromatic, antiaromatic or homoaromatic with reason (**any three**): 3



- (g) Between *tert*-butanol and *n*-butanol, which one is more soluble in water and why? 2
2. (a) Write the canonical forms of  $Me_2\ddot{N}-\overset{\ominus}{C}(OMe)-CH_3$ . Which one is the most contributing structure? -- Explain. 2
- (b) Calculate the formal charge on the nitrogen atom of trimethylammonium ion and write the Lewis structure of the species. 2

- (c) Bond energy of  $C-C$  is less than twice of that of  $C-C$  whereas bond energy of  $C=O$  is greater than twice of that of  $C-O$ . Explain why. 2
- (d) Compare the bond lengths ( $a$  vs  $a'$ ) of the following compounds with reason. 2



- (e) Arrange the following compounds in order of their increasing heat of hydrogenation values: 2  
*1-hexene*, *cis-3-hexene*, *trans-3-hexene*
- (f) When cyclooctatetraene is reacted with conc.  $H_2SO_4$ , a stable species is formed. Again when it is reacted with K metal in THF, another stable species is formed. Show the species formed in the two cases and account for their stability. 3
- (g) What is the difference between bond polarity and bond polarisability? 2
- (h) Draw the  $\pi$ -HOMO of buta-1,3-diene in the ground state. 1

### Unit-II

3. (a) Write down the product formed in the following reaction. Why is it called a pericyclic reaction? 2



- (b) What are singlet and triplet carbenes? Show the orbital diagram of each of them. 3
- (c) Compare the stability of the carbocations given below with reason: 2



- (d) Give one example of electrophilic radical. 1

4. (a) Compare the stabilities of the following free radicals 2



- (b) Give one example of each of pyramidal and planar carbanion. 2
- (c) Which of the following species behave as (i) a nucleophile, (ii) an electrophile, (iii) both nucleophile and electrophile and (iv) neither nucleophile nor electrophile? 2



(d) Explain the formation of the different products in the following reactions. 2



### Unit-III

5 (a) Draw the Fischer projection formula of (2S, 3R)-3-chlorobutan-2-ol. 2

(b) What is meant by stereogenic center? Are centers of stereogenicity always centers of chirality? Explain with suitable example. 3

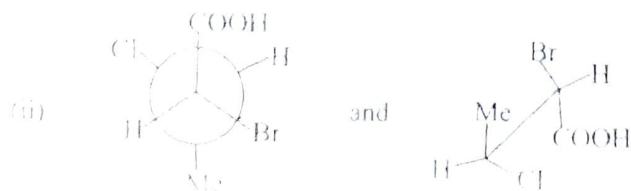
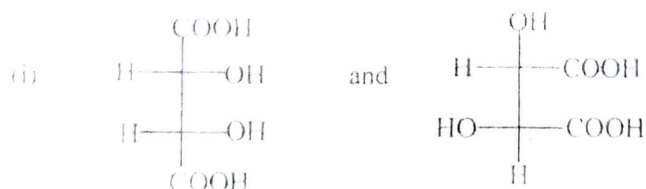
(c) Indicate the symmetry elements and point group of *trans*-1,2-dichloroethylene and chloroform. 3

(d) How many stereoisomers will  $\text{Me}-\text{CH}=\text{CH}-\text{CH}(\text{OH})-\text{Me}$  have? Draw the stereostructure of any one of them showing the appropriate configuration in terms of R-/S- and/or E-/Z-. 3

(e) The optically active ketone  $\text{Ph}-\text{CO}-\text{CH} \begin{matrix} \text{Me} \\ \text{Ph} \end{matrix}$  loses its optical activity when treated with a little base. Explain showing the mechanism. 3

(f) A sample of an optically active compound shows a specific rotation  $(- )28^\circ$ . If the specific rotation of its pure dextro form is  $(+ )70^\circ$ , find the molar ratio of the two enantiomers in the given sample. 2

6 (a) Judge whether the following pairs are homomer / enantiomer / diastereomer or constitutional isomer. 3



- (b) How do you resolve (1)  $\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{CH}_3$ ? 2
- (c) How many active and *meso*-forms are possible for pentane-2,3,4-triol? Draw the Fischer projection formula of one *meso*-form and point out the pseudo asymmetric centre and comment whether it will be chirotopic or achirotopic. 4
- (d) Write down the Fischer projection formula of D-glyceraldehyde and L-C<sub>2</sub>H<sub>4</sub>CH-CH(NH<sub>2</sub>)-COOH. 2
- (e) What are asymmetric and dissymmetric molecules? Explain with suitable examples. 3
- (f) State with reason whether the following molecule is resolvable. 2

