



**HCM-003-001506**

**B. Sc. (Sem. V) (CBCS) Examination**

**October - 2017**

**C - 502 : Organic Chemistry & Spectroscopy**

*(New Course)*

**Faculty Code : 003**

**Subject Code : 001506**

Time :  $2\frac{1}{2}$  Hours]

[Total Marks : 70

- Instructions :** (1) Total three questions; all questions are compulsory.  
(2) The figures written at the right side, indicate the marks of the question / sub question.

1 (A) Answer the following : **20**

(1) Give reaction of glucose with  $Br_2 / H_2O$ .

(2) Complete the following reaction:



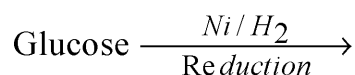
(3) Complete the following reaction.



(4) Give the reaction of Coniine distilled with Zn dust.

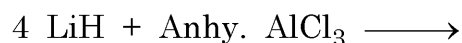
(5) Give structure and use of Saccharin.

(6) Complete the following reaction :



(7) Give the reaction of maleic anhydride with hydrazine hydrate.

(8) Complete the following reaction :



- (9) Complete the following reaction.  
 Glycol + Formaldehyde + 4 NH<sub>3</sub>  $\longrightarrow$
- (10) Give structure and use of Orange - II
- (11) Give point group of m-dichlorobenzene.
- (12) Define proper rotational axis.
- (13) What is Hypsochromic shift ?
- (14) Which isomer will show comparatively lesser  $\lambda_{\max}$  ?  
 cis or trans ?
- (15) Give the structure of the molecule having D<sub>3h</sub> point group.
- (16) Can we use the glass as sample cell in U. V. region ? Why ?
- (17) Give region of near IR, middle IR and far IR in  $cm^{-1}$ .
- (18) In  $C \equiv C - H$  group C-H stretching vibration is observed at \_\_\_\_\_  $cm^{-1}$ .
- (19) Give symmetry elements of compound having C<sub>3v</sub> point group.
- (20) Give characteristic infra red absorption frequencies of the Nitrile compound.

2 (A) Answer the following : (any **three**)

6

- (i) Give any two methods of preparation of Triphenyl phosphine.
- (ii) Explain with reaction : Glucose and Fructose form the same Osazone.
- (iii) [A] Give reaction of 2-chloro ethanal react with thiourea.  
 [B] Give reaction of propynal react with hydroxy amine.
- (iv) Give any two synthesis of Dioxane
- (v) Give synthesis of Coniine.
- (vi) Give synthesis and use of p-Anisyl urea.

- (B) Answer the following : (any **three**) **9**
- (i) Prove that the  $-\text{CH}_2-$  group is present between Isoquinoline and benzene ring in Papaverine.
  - (ii) Give any three applications of Hoffmann rearrangement.
  - (iii) Give synthesis of Pyrimidine.
  - (iv) Explain : Epimerization.
  - (v) Give synthesis and use of Alizarin.
  - (vi) Give synthesis of Papaverine.

- (C) Answer the following : (any **two**) **10**
- (i) Explain Arndt-Eistert reaction with mechanism.
  - (ii) Give synthesis and uses of :  
[A] Ibuprofen [B] Adrenaline
  - (iii) Explain Mutarotation with suitable example.
  - (iv) Prove that Nicotine is  $\beta$  - pyridyl -  $\alpha$  - pyrrolidine alkaloid.
  - (v) Explain Step-up and Step-down reaction with example.

- 3** (A) Answer the following : (any **three**) **6**
- (i) Give structure of the molecule having  $D_{4h}$  point group. Give its symmetry elements.
  - (ii) Explain : Fermi resonance
  - (iii) Explain : Inversion centre with example.
  - (iv) Explain : Improper rotational axis.
  - (v) Assign the structure to a compound having following characteristics.  
M. F. :  $\text{C}_9\text{H}_{12}$   
I. R. : 3050, 2930, 2890, 1595, 1490, 1450, 1380,  
1020, 830  $\text{cm}^{-1}$
  - (vi) Calculate  $\lambda_{\text{max}}$  for p-chlorobenzaldehyde.

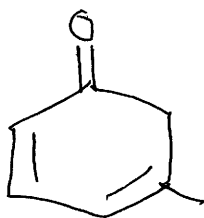
(B) Answer the following : (any **three**) 9

- (i) Prove that  $S_n^n = E$  in staggered ethane.
- (ii) Explain : Finger print region.
- (iii) Explain overtone in IR spectra.
- (iv) Construct multiplication table for  $C_{2h}$  point group.
- (v) Assign the structure to a compound having following characteristics.

M. F. :  $C_9H_8$

I. R. : 3300, 3050, 2930, 2890, 2190, 1595, 1490,  
1380, 1020, 750, 700,  $cm^{-1}$

- (vi) Calculate  $\lambda_{max}$  for following compound.



(C) Answer the following : (any **two**) 10

- (i) Give point groups of
  - [A]  $CO_2$
  - [B] Ethylene
  - [C] 1, 3, 5 – trichlorobenzene
  - [D]  $CCl_4$
  - [E]  $SO_2$
- (ii) Explain difference between  $C_n$  and  $S_n$ .
- (iii) Explain the effect of polar solvent on  $\pi \rightarrow \pi^*$  and  $n \rightarrow \pi^*$  transition band of carbonyl group.
- (iv) Discuss the factors affecting the position of carbonyl group in infra red spectroscopy.
- (v) Explain different types of "Plane of symmetry".

### Spectral Data

U.V. :

Empirical rules for Dienes :

	(A) Homoannular $\lambda = 253 \text{ nm.}$	(b) Heteroannular $\lambda = 215 \text{ nm.}$
Increments for double bond extending conjugation	30 nm.	30 nm.
Exocyclic double bond	5	5
Alkyl substitution or ring residue	5	5
Homocyclic Diene components	39	39
Polar groups :		
- $\text{OCOCH}_3$	0	0
- OR	6	6
- Cl, -Br	5	5
- $\text{NR}_2$	60	60
(C) Simple Diene :		
Parent $\lambda = 217 \text{ nm.}$		
Polar groups :		
Alkyl subst for ring residue	5 nm	
-Cl, -Br	17	
-OH	5	
-OR	5	
- $\text{NR}_2$	60	
-SR	30	
(D) Empirical Rules for Enones and Dienones :		
(a) Z = C		$\lambda$
(1) 6 membered ring or acyclic		215
(2) 5 membered ring		202
(b) Z = H		207
(c) Z = OH or OR		193
(d) Acyclic dienone		245
Increment for :		
Double bond extending conjugation		30
Alkyl group of ring residue		$\alpha$ 10
		$\beta$ 12
	$\gamma$ or higher	18
Exocyclic double bond position		5
Homocyclic diene component		39

Polar groups	$\alpha$	$\beta$	$\gamma$	$\delta$ other
-Cl	15	12	.	.
-OH	35	30	50	50
-OR	35	30	17	31
-NR <sub>2</sub>	.	93	.	.
-O	.	75	.	.
-NHCOR	.	95	.	.
-OCOCH <sub>2</sub>	6	6	.	6
-SR	.	85	.	.
-Br	25	30	.	.
-NO <sub>2</sub>	.	95	.	.

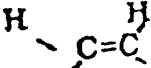
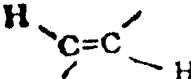
(e) Empirical Rules for Benzoyl Derivative :

Parent Chromophor :	mm
Z = alkyl or ring residue	246
Z = H	250
Z = -OH or -OR	230

Increment for each substituent :	$\sigma$	$\tau$	$\rho$
Alkyl or ring residue	3	3	10
-OH; -OCH <sub>3</sub> -OR	7	7	25
.O	11	20	78
.Cl	0	0	10
.Br	2	2	15
.NH <sub>2</sub>	13	13	58
.NHCOCH <sub>2</sub>	20	20	45
.NHCH <sub>3</sub>	.	.	73
.N(CH <sub>2</sub> ) <sub>3</sub>	20	20	85

Infra - Red Data

Alkene (stretching)	-C-H	2850-2960(v)
Alkene	=C-H	3100-3200(m)
Alkyene	=C-H	3200-3300(s)
Aromatic	ArC-H	3010-3100(m)
Aromatic ring	C=C	1500-1600(v) (two to three)
Alkene	>C=C<	1610-1680(v)
Alkyene	-C=C <sup>2</sup> .	2100-2260(s)
Alkene (Bending)	-C-H	1340(w)
	-C(C <sub>2</sub> H <sub>3</sub> ) <sub>3</sub>	1430-1470(m) & 1380-1385(s)
	-C(CH <sub>2</sub> ) <sub>3</sub>	1365 (s)
Aldehyde	-C-H	2820-2000(w)&2650 2760(s)
Aldehyde	C=O	1740-1720(s)
Ketone	C=O	1725-1710(s)
Carboxylic acid	C=O	1725-1705(s)
Ester	C=O	1750-1730(s)
Amide	C=O	1670-1640(s)
Anhydride	C=O	1810-1860(s)&1740-1790
Alcohols, Ethers, esters		
Carboxylic acids, Anhydride	C-O	1300-1000(s)

Alcohols, phenols :		
Free	O-H	3650-3600(sh)
bonded	O-H	3500-3200(b)
Carboxylic acids		
Free	O-H	3500-3650(m)
H-bonded	O-H	2500-3200(b)
amines (stretch)	N-H	3330-3500(m)
Bnding	N-H	1640-1550(m)
Nitrile	C=N	2210-2280(s)
Ether	O	1070-1150(s)
Alkene bending		
disulstituted Cis.		-690(s)
disulstituted Trans.		960-970(s)
Aromatic substitution :		
Type C-H out of plane bending		
No. of adjacent H atom.		range cm
5		750(s) & 700(s)
4		750
3		780
2		830
1		850