Seat No. _____

# HAK-003-2015006

## B. Sc. (Sem.-V) (CBCS)

## (W.E.F. 2019) Examination

**May - 2023**

## Chemistry : C-502

*(Organic Chemistry & Spectroscopy)*

*(New Course)*

**Faculty Code : 003**

**Subject Code : 2015006**

Time : $2\frac{1}{2}$ Hours / Total Marks : **70**

**Instructions :**

(1) Total five questions.

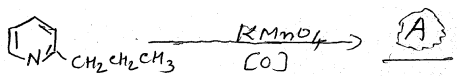
(2) All questions are compulsory.

(3) Figures to the right side indicate marks of the question.

**1** (a) Answer the following questions : **4**

(1) Write the structure of 1-methyl iso quinoline.

(2) Conine $\xrightarrow[300\,C]{HI}$ (A)

(3)  (A)

(4) Write the structure of Cinnamic acid.

(b) Answer the following : (any **one**) **2**

(1) Give synthesis of veratric acid from p-Hydroxy benzoic acid.

(2) Give synthesis of N-methyl-2-pyrrolidine from succinimide.

(c) Answer in brief : (any **one**) **3**

(1) Give synthesis of coniine from pyridine by Ledenberg method.

(2) Explain Curtius rearrangement with reaction.

(d) Answer in detail : (any **one**) **5**

(1) Exlain Perkin reaction.

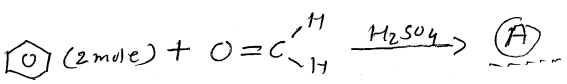
(2) Explain Constitution of Nicotine.

**2** (a) Answer the following questions : **4**

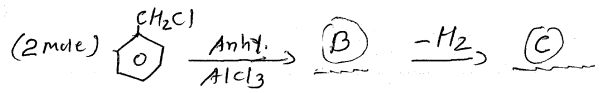
(1) Write the structure of D(+) Allose.

(2) D(-) Fructose + $H_2NOH \xrightarrow{-H_2O}$ (A)

(3) 

(4) 

(b) Answer the following : (any one) **2**

(1) 

(2) Give method of preparation of Tollen's reagent.

(c) Answer in brief : (any **one**) **3**

(1) Explain step-down reaction (Ruffs method)

(2) Give D(+) glucose and D(-) Fructose reactions with (i) Hydroxyl amine and (ii) HCN.

(d) Answer in detail : (any **one**) **5**

(1) Explain configuration of D(+) Fructose.

(2) Give oxidation reaction of Naphthalene (any five)

**3** (a) Answer the following questions : **4**

(1) Write the structure of Chrysodine-G.

(2) Give the structure of Trans 1,4 dimethyl cyclohexane.

(3) Give possible transition in acetone.

(4) Define wave length.

(b) Answer the following : (any **one**) **2**

(1) Explain β-carotene is coloured why ?

(2) Give synthesis of Isobutyl benzene.

(c) Answer in brief : (any **one**) **3**

(1) Explain conformation of Mono-substituted cyclohexane.

(2) Explain chromophore and Auxochrome.

(d) Answer in detail : (any **one**) **5**

(1) Explain chemical shift in U.V. spectra (all four types)

(2) Give synthesis and uses of (i) Auramine (ii) Saccharine

**4** (a) Answer the following questions : **4**

(1) Define Point of Inversion.

(2) Give point group of Eclipsed CHFCI - CHFCI

(3) Give point group of $XeOF_4$.

(4) Give point group of Glyoxal.

(b) Answer the following : (any **one**) **2**

(1) Rotation of 792° gave structure equivalent to the identity. Find out the value of $k$ and $n$ in $C_n^k$.

(2) The point group of 1,3-dicholoro benzene is $C_{2V}$ while point group of 1,4-Dichloro benzene is $D_2h$ why ? Give sym. elements.

(c) Answer in brief : (any **one**) **3**

(1) Explain Law of Association for $NH_3$ molecule A (B×C)=(A×B) C where A = $C_3$, B = $\sigma v_1$ C = $\sigma v_3$

(2) Find out point group of $H_2O$ and construct multiplication table for it.

(d) Answer in detail : (any **one**) **5**

(1) Prove that in staggered ethane $S_6^6 = E$ OR $S_n^n = E$ when $n$ is even number.

(2) Explain different types of plane of symmetry with example.

**5** (a) Answer the following questions : **4**

(1) Write expected IR frequency of phthalic anhydride.

(2) In -CHO group C-H stretching vibration is observed at ___, ____ $cm^{-1}$.

(3) How can you identify Aromatic and Aliphatic compound by IR frequency.

(4) In IR spectroscopy which material is used for make up of prism.

(b) Answer the following : (any **one**) **2**

(1) Explain bending vibration of IR spectra.

(2) Give expected (approx) IR value in $cm^{-1}$ for phenyl acetic acid.

(c) Answer in brief : (any **one**) **3**

(1) What are P,Q,R branches of spectra ? Derive their equation.

(2) Distinguish acetamide and ethyl amine by IR-frequency

(d) Answer in detail : (any **one**) **5**

(1) Derive the structural formula of compound from the following IR-data.

M.F. = $\underline{C_{11}H_{12}}$ : IR : 3310, 3045, 2925, 2130, 1605, 1500, 1430, 1380, 1360, 1080, and 840 $cm^{-1}$.

(2) Derive the structural formula from IR data.

M.F. = $C_{14}H_{12}$ : IR: 3100-3000 (m), 1620-1590, 1500-1460, 990(s), 770(s), 690 (s) $cm^{-1}$.

# IR - DATA

| | Type of Vibrartion | Frequency($cm^{-1}$) | Intensity |
|---|---|---|---|
| [1] | **Hydrocarban :-** | | |
| | C-H Straching vibration | | |
| | (a) Alkane Strech vib $\xrightarrow{CH_3/CH_2}$ | 2990-2850 | m,s |
| | (b) Alkene Strech vib $\xrightarrow{>C=CH_2}$ | 3100-3000 | m |
| | (c) Strech vib $\xrightarrow{-C\equiv C-H}$ | 3300 | S.V. |
| | (d) Aromatic Strech vib $\xrightarrow{Ar-H}$ | 3030 | m |
| [2] | **C-H Bending Vibration :-** | | |
| | (a) (i) $CH_3$ - Bending | 1450 | s |
| | (ii) $CH_2$ - Bending | 1465 | m |
| | (iii) CH - Bending | 1340 | w |
| | (b) Isoprobyl $-CH(CH_3)_2$ | 1375, 1385 (Doublet) | s |
| | (c) Tert-butyl $-C(CH_3)_3$ | 1365, 1390 (Doublet) | m |
| | (d) Alkene bending rib | 1420-690 | m |
| | (e) Alkene CiS $H_2C=CH$ | 690 | |
| | Trns $H_2C=CH$ | 970 | |
| | (f) Alkene bending vib | 630 | s |
| | $CH_2$ Roking (More then four $CH_2$ group) | 720 & 625 | m |
| [3] | **C-C Multiple Band :-** | | |
| | (a) C = C Alkene strech vib | 1680-1600 | m v |
| | (b) C ≡ C Alkene strech vib | 2250-2100 | m v |
| | (c) C = C Aromatic ring scalatal vib | 1600,1580<br>1500,1450 | m |
| [4] | **C=O Carbonyl group** | | |
| | (a) (i) C=O Acid | 1700 | (s) |
| | (ii) O-H (Strech) $-\overset{O}{\overset{\|\|}{C}}-OH$ broad<br>Acid | 2700-3200 | (w) |
| | (b) Ketone | 1715 | (s) |
| | (c) (i) Aldehyde | 1745 | (s) |
| | (ii) C-H Strech vib CHO | 2820, 2750 (Doublet) | (s) |

| | Type of Vibrartion | Frequency($cm^{-1}$) | Intensity |
|---|---|---|---|
| (d) | (i) Ester → | 1750-1735 | (s) |
| | (ii) Aromatic or unsaturated → | 1730-1715 | (s) |
| (e) | Acid Halide → | 1800 | (s) |
| (f) | Anhydride → | 1810, 1760 (Doublet) | (s) |
| [5] | **$CONH_2$ Amide :** | | |
| (i) | C=O Strech Vib → | 1650 | (s) |
| (ii) | Due to $NH_2$ Group also at → | 3400 | s |
| [6] | **C-O** | | |
| (i) | Alconols ,Acids,Anhydrides → | 1300-1000 | m |
| (ii) | Ether → (R - O - R) → | 1200-1100 | m |
| (iii) | Ester → (COOR) → | 1245, 1045 (Doublet) | m |
| [7] | **O-H** | | |
| (i) | Free -OH (Alcohola,Phenls) → | 3650-3600 | (s) |
| (ii) | H-bonded (Inter -Molecular) → | 3500-3200 | (m) |
| (iii) | Carboxyls Acid (Broad) → | 3400-2700 | (w) |
| [8] | N-H (Amine) | | |
| (i) | Primary amine -> $NH_2$ Free ⟹ | 3500, 3400 (Doublet) | (m) |
| (ii) | N-H bending → | 1650-1550 | m |
| (iii) | Secondry amine (=NH) → | 3500-3100 | m |
| [9] | C-N | | |
| | Strech vib Aromatic → | 1350-1200 | m |
| | Aliphatic → | 1200-1000 | m |
| | C=N → Amines of oximes → | 1690-1640 | (w) |
| | C≡N → Nitriles → | 2260-2240 | (m) |
| [10] | $NO_2$ Nitrugroup → | 1550-1350 | (s) |
| | S-H -> Marcaptans → | 2550 | m |
| | S=O → (i) Sulfoxides → | 1050 | (s) |
| | (ii) Sulfones,Sulfony,Chlorides ($SO_2Cl$) → | 1375-1300 | (s) |
| | (iii) Sulfats,Sulfonmides Ar-$So_2NH_2$ → | 1200-1140 | (s) |
| [11] | | | |
| | C-F → Floride → | 1400-1000 | (s) |
| | C-Cl → Chloride → | 800-600 | s |
| | C-Br → Bromide → | 617 | s |
| | C-I → Iodide → | 500 | s |

Substitution →
- Mono (Two bonds) ==> 700 & 650
- Ortho (Single) ==> 750 ± 20
- Meta (Two bonds) ==> 710 & 750
- Pera (Single) ==> 820 ± 20