Seat No. _____

HA-003-1016007

B. Sc. (Sem. VI) (CBCS) (W.E.F. 2016) Examination

April - 2023

Chemistry : C - 602

(Organic Chemistry & Spectroscopy) (Old Course)

Faculty Code : 003

Subject Code : 1016007

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

Instructions : (1) This paper contains five questions.
(2) All questions are compulsory.
(3) Figure to the right indicate full marks.

1 (a) Answer the following questions : **4**
(1) Give the structure of p-cymene.
(2) The molecular formula of Citral is _____.
(3) Give full name of RDX.
(4) Write the structure of Baygon.

(b) Answer any **one** of following : **2**
(1) Give the structure of terabic acid.
(2) Write uses of Trinitro toluene.

(c) Answer any **one** of following : **3**
(1) Synthesis of musk ketone.
(2) Give conversion of α-Terpineol from p-Toluic acid.

(d) Answer any **one** of following : **5**
(1) Explain constitution of α-Terpineol.
(2) Give synthesis and uses of -
(i) P.E.T.N.
(ii) Musk Xylene.

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

(1) Define : Amino Acids.

(2) Complete it : Alamine + HNO_2 $\longrightarrow$ _____.

(3) Write Biuret test.

(4) Give structure of Ninhydrin.

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

(1) Explain : Isoelectric point.

(2) Define : Dipeptides, give one example of it.

(c) Answer any **one** of following : **3**

(1) Give the synthesis of phenylalanine by Erlenmeyer Azlactone method.

(2) Give synthesis of Thyroxine.

(d) Answer any **one** of following : **5**

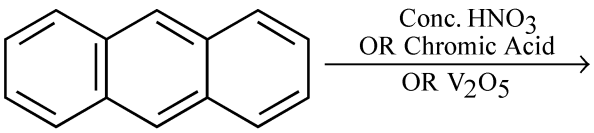
(1) Discuss : Constitution of Thyroxine.

(2) Write colour reactions of proteins.

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

(1) Define : Polynuclear hydrocarbon.

(2) Complete it :



(3) Define : Metastable ion.

(4) Draw the chair and boat conformation for cyclohexane.

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

(1) Give Structure :

(i) Diphenyl methane

(ii) Naphthalene

(2) State any two conditions required for Mc-Lafferly rearrangement.

(c) Answer any **one** of following : **3**

(1) Explain mass spectra of alkane.

(2) Give the synthesis of Naphthalene by Haworth method.

(d) Answer any **one** of following : **5**

(1) Write note on : Mass instrumentation.

(2) Explain conformational analysis of methyl cyclohexane.

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

(1) What is chemical shift?

(2) What is coupling constant?

(3) Why ^{12}C, ^{16}O do not show NMR spectra?

(4) Which solvents are used in NMR spectroscopy?

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

(1) Define : Equivalent protons and non-equivalent protons.

(2) How will you distinguish between methyl formate and acetic acid by NMR spectroscopy?

(c) Answer any **one** of following : **3**

(1) Discuss magnetic anisotropy in Benzene.

(2) Give possible isomer of dibroma propane and give no. of NMR signals.

(d) Answer any **one** of following : **5**

(1) Explain the factors affecting chemical shift in NMR spectra.

(2) Write short notes on Deuterium Labeling.

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

(1) What is Nitrogen rule?

(2) Which group is present in compound by IR spectral data is greater than 3200 cm^{-1}?

(3) Give no. of signal in m-Xylene.

(4) What should indicate if λ_{max} is greater than 215 nm?

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

(1) Explain it :

(i) Geminal protons

(ii) Vicinal protons

(2) Give structural formula from following data :

M.F. : $C_3H_6Br_2$

a Triplet $\delta = 3.4$ 4H

b Quintlet $\delta = 1.5$ 2H

(c) Answer any **one** of following : **3**

(1) Define DBE with example $C_8H_8O_2$.

(2) Give structural formula of the compound $C_8H_{18}O$ giving only one NMR signal.

(d) Answer any **one** of following : **5**

(1) Assign the structure from the following data :

M. F. : $C_4H_8O_2$

IR : 2840, 1740, 1373, 1239, 1049, 847 cm^{-1}

NMR : Triplet $\delta = 2.25$ (3H)

Quartet $\delta = 4.5$ (2H)

Singlet $\delta = 3.02$ (3H)

(2) Assign the structure from the following data :

M. F. : C_9H_9NO

IR : 3030, 2975, 2270, 1590, 1530, 1385, 1210 and 840 cm^{-1}

NMR : a Triplet $\delta = 1.2$ ppm 3H

b Doublet $\delta = 7.5$ ppm 2H

c Doublet $\delta = 7.8$ ppm 2H

d Quartet $\delta = 2.3$ ppm 2H

Spectral Data

U.V. :

Empirical rules for Dienes :

	(A) Homoannular $\lambda = 253$ nm	(B) Heteroannular $\lambda = 215$ nm
Increments for double bond extending	30 nm	30 nm
conjugation Exocyclic double bond	5	5
Alkyl substitution or ring residue.	5	5
Homocyclic Diene Components	39	39
Polar Groups :		
$-OCOCH_3$	0	0
– OR	6	6
– Cl, – Br	5	5
$-NR_2$	60	60

(C) Simple Diene :

Parent $\lambda = 217$ nm

Polar Groups :

Alkyl subst for ring Residue	5 nm
–Cl, – Br	17
–OH	5
–OR	5
$-NR_2$	60
–SR	30

(D) Empirical Rules for Enones and Dienones :

	λ
(a) Z = C	
(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 :	
	Doyble bond extending conjugation	30
	Alkyl group of ring residue	α 10
		β 12
	γ or higher	18
	Exocyclic double bond position	5
	Homocyclic diene component	39

Polar Groups	α	β	γ	δ' other
–Cl	15	12	–	–
–OH	35	30	50	50
–OR	35	30	17	31
$-NR_2$	–	93	–	–
–O	–	75	–	–
–NHCOR	–	95	–	–
$-OCOCH_2$	6	6	–	6
–SR	–	85	–	–
–Br	25	30	–	–
$-NO_2$	–	95	–	–

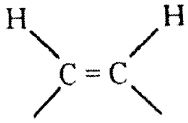
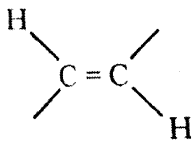
(e) Empirical Rules for Benzoyl Derivative :

Parent Chromophor :	mm		
Z = alkyl or ring residule	246		
Z = H	250		
Z = –OH or –OR	230		
Increment for each substituent :	Q	M	R

Alkyl or ring residue	3	3	10
–OH; $-OCH_3$, –OR	7	7	25
–O	11	20	78
–C*l*	0	0	0
–Br	2	2	15
$-NH_2$	13	13	58
$-NHCOCH_2$	20	20	45
$-NHCH_3$	–	–	73
$-N(CH_2)_3$	20	20	85

Infra – Red Data

Alkene (Strcteching)	–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	$-C=C^2$	2100-2260(s)
Alkene (Bending)	–C–H	1340(w)
	$-C(C_2H_3)_3$	1430-1470(m) & 1380-1385(s)
	$-C(CH_2)_3$	1365 (8)
Aldehyde	–C–H	2820-2000(w) & 2650 2760 (s)
Adehyde	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		
Free	O–H	3500-3650(m)
H-bonded	O–H	2500-3200(b)
Amines (stretch)	N–H	3330-3500(m)
Bonding	–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