



**DQ-003-1016007**

Seat No. \_\_\_\_\_

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

**April - 2022**

**Chemistry : C-602**

*(Organic and Spectroscopy)*

*(New Course 2016)*

**Faculty Code : 003**

**Subject Code : 1016007**

Time : **2.30** Hours]

[Total Marks : **70**

- Instruction :** (1) All the questions are compulsory.  
(2) All the questions carry equal 14 marks each.

- 1** (A) Answer the following questions. **4**
- (1) Draw the structure of Isoprene.
  - (2) What is the common unit in all terpenoids ?
  - (3) What is the full form of PETN ?
  - (4) Give two examples of Explosive.
- (B) Answer in brief. (one out of two) **2**
- (1) Write short note on Baygon.
  - (2) Complete the reaction :
- $$\text{p-Toluic acid} \xrightarrow[\text{H}_2\text{SO}_4]{\text{Conc.}} \text{A} \xrightarrow[\text{fusion}]{\text{KOH}} \text{B}$$
- (C) Answer in detail. (one out of two) **3**
- (1) Describe the classification of terpenoids.
  - (2) Give synthesis and uses of Musk Xylene and Musk Ketone.
- (D) Write notes on. (one out of two) **5**
- (1) Synthesis and uses of TNT
  - (2) Prove the structure of  $\alpha$ -Terpeniol

- 2 (A) Answer the following questions. 4
- (1) Give the structure of Alanine.
  - (2) What is zwitter ion ?
  - (3) Define protein.
  - (4) Give name of the following :  

$$\text{C}_6\text{H}_5 - \text{H}_2\text{C} - \text{CH} - \text{COOH}$$

$$\quad \quad \quad |$$

$$\quad \quad \quad \text{NH}_2$$
- (B) Give Answers in brief. (one out of two) 2
- (1) Give difference between protein and polypeptide.
  - (2) Discuss biuret test.
- (C) Give Answers in detail. (one out of two) 3
- (1) Write note on Zwitter ion.
  - (2) Explain isoelectric point.
- (D) Explain following in detail. (one out of two) 5
- (1) Give the synthesis of  $\alpha$ -amino acids
  - (2) Prove the structure of thyroxene.
- 3 (A) Answer the following questions. 4
- (1) Give structure of Anthracene
  - (2) Define Isomers
  - (3) Angle strain is also known by which name ?
  - (4) What is base peak in mass spectra ?
- (B) Answer in brief. (one out of two) 2
- (1) Explain chair form of cyclohexane
  - (2) Give physical properties of Naphthalene
- (C) Answer in detail. (one out of two) 3
- (1) Describe type of strain.
  - (2) Give classical formula and conformation for 1, 3 - disubstituted - cyclohexane

- (D) Write notes on following : (one out of two) 5
- (1) Give the synthesis of Anthracene
  - (2) Explain : Mass spectrometer Instrumentation.
- 4 (A) Answer the following. 4
- (1) Which types of solvents are used in NMR ?
  - (2) What is chemical shift value for TMS ?
  - (3) How many types of protons are in following :  
Ethylene.
  - (4) Define chemical shift.
- (B) Answer in brief. (one out of two) 2
- (1) State the basic principle of NMR spectroscopy.
  - (2) Why TMS is used in NMR spectroscopy ?
- (C) Answer in detail. (one out of two) 3
- (1) Explain shielding and deshielding effect.
  - (2) Give the number of PMR signals and their multiplicity in 2-Butanone.
- (D) Explain in detail. (one out of two) 5
- (1) Give the difference between chemical shift and spin-spin coupling.
  - (2) State the different components of NMR Instrumentation.
- 5 (A) Answer the following. 4
- (1) What is DBE ?
  - (2)  $\geq C = 0$  - gp identified by which spectra ?
  - (3) Calculate DBE for the formula  $C_8H_8O_2$ .
  - (4) Give structural formula for  $C_4H_6O_4$  which can give only TWO NMR signals.

- (B) Answer in brief. (one out of two) 2
- (1) Explain number of signals and splitting for compound  $\text{CH}_3\text{CHBrCH}_2\text{CHO}$
  - (2) Differentiate acetophenone and benzaldehyde using NMR spectra.
- (C) Answer in detail. (one out of two) 3
- (1) On the basis of data given determine the structural formula at following compound.  
 Mol. Formula  $\text{C}_9\text{H}_{10}\text{O}_2$ .  
 IR : 3030, 2930, 1670, 1598, 1258, 1021, 833  $\text{cm}^{-1}$   
 NMR : (a) Singlet  $\delta$  2.5 (3H), (b) Singlet  $\delta$  3.9 (3H),  
 (c) Complex  $\delta$  7.8 (4H)
  - (2) Determine the molecular structure for the following compound from the given data :  
 Molecular Formula  $\text{C}_8\text{H}_6$   
 IR : 3300, 3040, 2100, 1605, 1579, 1500, 750, 700  $\text{cm}^{-1}$   
 NMR : (a) Singlet  $\delta$  2.3 (1H),  
 (b) Complex  $\delta$  7.4 (5H)
- (D) Answer any one of the following. 5
- (1) Determine the molecular structure from the given data for following compound.  
 Mol. Formula  $\text{C}_{11}\text{H}_{16}$   
 IR data : 3035, 2980, 2890, 1605, 1580, 1450, 1390, 1365, 834  $\text{cm}^{-1}$   
 NMR data : (a) Singlet  $\delta$  1.0 (27.5 squares)  
 (b) Singlet  $\delta$  2.8 (9.2 squares)  
 (c) Complex  $\delta$  7.4 (12.4 squares)

- (2) Give the structure to a compound having following characteristics :

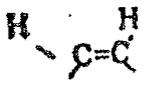
Molecular weight 164 g/mole.

73.17% C, 7.32% H, 19.5% O.

IR ( $\text{cm}^{-1}$ ) : 3050, 2960, 1735, 1605, 1575, 1470,  
1440, 1100, 835

NMR (ppm) :  $\delta$  2.5 Singlet 3H,  $\delta$  1.2 Triplet 3H,  
 $\delta$  2.7 Quartet 2H,  $\delta$  7.3 doublet 2H,  
 $\delta$  7.7 doublet

*Spectral Data -*

<b>Infra - Red Data</b>		
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		
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		-690(s)
disubstituted Cis.		
disubstituted Trans.		960-970(s)
<b>Aromatic substitution :</b>		
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

NMR Data : Chemical Shift

Types of proton		Chemical shift in $\delta_{ppm}$
Primary	R-CH <sub>3</sub>	0.9
Secondary	R <sub>2</sub> -CH <sub>3</sub>	1.3
Tertiary	R <sub>3</sub> -CH	1.5
Vinylic	C=C-H	4.6-5.9
Acetylinic	Cr-C-H	2.3
Aromatic	Ar-H	6-8.5
Benzylic	Ar-C-H	2.2-3
Allylic	C=C-CH <sub>3</sub>	1.7
Florides	H-C-F	4-4.5
Chlorides	HC-Cl	3.4
Bromides	HC-Br	2.5-4
Iodides	HC-I	2.4
Alcohols	HC-OH	3.4-4
Ethers	HC-OR	3.3-4
Esters	R-COO-CH	3.7-4.1
Acids	HC-COOH	2-2.6
Carbonyl comp.	HC-C=O	2-2.7
Aldehyde	R-CHO	9-10
Hydroxylic	R-OH	1-5.5
Phenolic	Ar-OH	4-12
Carboxylic	R-COOH	10.5-12
Amino	R-NH <sub>2</sub>	1.5

---