



M.Sc. (Final)

Term End Examination, 2017-18

# CHEMISTRY

## Paper - I

# Application of Spectroscopy, Photochemistry and Solid State Chemistry

*Time : Three Hours]      [Maximum Marks : 100*

*[Minimum Pass Marks : 36*

**Note** : Answer any **five** questions. The figures in the right-hand margin indicate marks.

1. (a) Explain symmetry and shape of  $AB_3$ ,  $AB_4$  and  $AB_5$  types of molecule. 6
- (b) Describe hyperfine interaction in ESR spectroscopy. 8
- (c) What is the significance of 'g' tensor? 6
2. (a) Discuss the various factors which influences the vibrational frequencies of carbonyl group in IR spectroscopy. 6

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- (b) What is the effect of hybridisation of carbon on the stretching frequency of C—H bond in IR spectroscopy? 6
- (c) How will you differentiate the following pairs of compounds with the help of IR spectroscopy? 8
- (i) Primary alcohol and Secondary alcohol
- (ii) Malic acid and Fumaric acid
3. (a) Illustrate chemical shift. Explain the various factors which are responsible for affecting the magnitude of chemical shift. 8
- (b) Explain Karplus curve and give its applications. 6
- (c) Discuss spin-spin interaction between two nuclei. 6
4. (a) Show the various electronic transitions taking place when cinnamaldehyde molecule absorbs UV radiations. 5
- (b) How cis and trans stilbene can be distinguished by UV spectroscopy. 5
- (c) Explain the term optical rotatory dispersion (ORD) and circular dichroism (CD). 5
- (d) Discuss the effect of solvent polarity on  $\pi-\pi^*$  transition and  $n-\pi^*$  transitions. 5

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5. (a) Write notes on any **two** of the following : 5×2
- (i) McLafferty Rearrangement
  - (ii) Mass spectral fragmentation of branched chain hydrocarbon
  - (iii) Biological applications of Mossbauer spectroscopy
- (b) Identify the following isomeric alcohol: 5
- (i)  $\text{CH}_3 - \text{CH}_2 - \text{CH}_2\text{OH}$
  - (ii)  $\begin{array}{c} \text{CH}_3 - \text{CH} - \text{CH}_2\text{OH} \\ | \\ \text{CH}_3 \end{array}$
  - (iii)  $\begin{array}{c} \text{CH}_3 - \text{CH} - \text{CH}_2 - \text{CH}_3 \\ | \\ \text{OH} \end{array}$
  - (iv)  $\begin{array}{c} \text{CH}_3 \\ | \\ \text{CH}_3 - \text{C} - \text{OH} \\ | \\ \text{CH}_3 \end{array}$
- (c) Explain COSY and NOESY techniques. 5
6. (a) What is the fate of excited molecule? 8
- (b) Describe the different types of photochemical reactions. Explain photodissociation reaction with suitable examples. 8
- (c) What is photosensitization reaction? 4

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| 7.  | Write notes on any <b>four</b> of the following :  | 5×4 |
|     | (a) Photo-Fries rearrangement  |     |
|     | (b) Barton reaction  |     |
|     | (c) Cyclohexadienone rearrangement   |     |
|     | (d) Oxetane formation  |     |
|     | (e) Quantum yield  |     |
|     | (f) Photoisomerization of benzene  |     |
| 8.  | (a) Give detailed account on photochemical cis-trans isomerization                           | 10  |
|     | (b) Discuss the photochemistry of saturated cyclic ketones.                                  | 10  |
| 9.  | (a) Discuss the kinetics of solid state reaction.  | 6   |
|     | (b) What do you mean by point defects, line defects and plane defects ?                      | 6   |
|     | (c) Explain superconductivity. Give the uses of organic superconductors.                     | 8   |
| 10. | (a) On the basis of Band theory differentiate among conductor, semi-conductor and insulator. | 10  |
|     | (b) How Ferromagnetic properties originated in substances ?                                  | 5   |
|     | (c) Write a note on photoelectric effect.  | 5   |