



# GD-608

M.Sc. 3rd Semester  
Examination, Dec.-Jan., 2022-23

## CHEMISTRY

### Paper - I

Resonance Spectroscopy,  
Photochemistry and Organocatalysis

Time : Three Hours] [Maximum Marks : 80  
[Minimum Pass Marks : 16

Note : Answer all questions. The figures in the right-hand margin indicate marks.

#### Unit-I

- 1. (a) Explain the ESR spectrum of  $[\text{VO}(\text{H}_2\text{O})_5]^{2+}$  complex ion. 6
- (b) Predict the number of spectral lines in the ESR spectrum of following species : 8
- (i)  $[\text{CF}_2\text{H}]^\bullet$

- (ii)  $[\text{CF}_2\text{D}]^\bullet$
- (iii)  $[\text{C}^{13}\text{CH}_3]^\bullet$
- (iv)  $[\text{CClH}_2]^\bullet$

- (c) Calculate the g-value if  $^{13}\text{CH}_3^\bullet$  shows ESR signal at 0.5502T in a spectrometer operating at 9000  $\mu\text{Hz}$ . 6

OR

- (a) At which ranges of electromagnetic radiations one can observe ESR and NQR spectra ? 2
- (b) What do you understand by the term 'Nuclear quadrupole'? Discuss the principle and applications of NQR spectroscopy. 12
- (c) Describe zero-field splitting and Kramer's degeneracy. 6

#### Unit-II

- 2. (a) Write the applications of ESCA. 8
- (b) Explain the basic principle of photoelectron spectroscopy and correlate the significance of Koopman's theorem with PES. 6
- (c) Describe the origin of Auger spectrum. 6

OR

(3)

- (a) Define the basic difference between UPS and XPS. 6
- (b) What do you understand by 'photoacoustic effect'? Write down the advantages of PAS over the conventional absorption spectroscopy. 10
- (c) Name the 'reference material' commonly used in double beam instruments for PAS. Give reason for its use. 4

Unit-III

3. (a) What are the types of electronic excitations? Explain the fate of an excited molecule. 10
- (b) Describe the rate constants and life times of reactive energy states. 10

OR

- (a) Describe the singlet molecular oxygen reactions. 10
- (b) Explain the following reactions: 10
- (i) Barton reaction
- (ii) Photochemistry of vision

Unit-IV

4. (a) Explain the terms Energetics, catalytic cycle, catalytic efficiency and selectivity, with reference to the organocatalysis. 10

(4)

- (b) Explain the following: 10
- (i) Oxidative addition and reductive elimination
- (ii) Ligand substitution
- OR
- (a) Explain Palladium-Catalysed C — C bond forming reactions. 10
- (b) Describe the following reactions: 10
- (i) Wacker oxidation of alkenes
- (ii) Fischer-Tropsch synthesis