

**November 2025**  
**M.Sc.**  
**Third Semester**  
**DISCIPLINE SPECIFIC ELECTIVE – 01**  
**CHEMISTRY**  
*Course Code: MCHD 3.11*  
(Analytical Chemistry & Catalysis)

Total Mark: 70  
Time: 3 hours

Pass Mark: 28

Answer five questions, taking one from each unit.

**UNIT-I**

1. (a) Explain the principle involved in atomic absorption spectrometry. 4
- (b) Write a short note on each of the following: 2×2=4
  - (i) Voltammetry
  - (ii) Ion-selective electrodes
- (c) What are the factors affecting conductivity measurements? 2
- (d) Discuss the principle involved in polarography and give its applications. 4
2. (a) Give the differences between fluorescence and phosphorescence. 4
- (b) Write a short note on each of the following: 2×2=4
  - (i) Coulometry
  - (ii) Amperometry
- (c) Explain cyclic voltammetry and mention its applications. 3+3=6

**UNIT-II**

3. (a) Discuss the principles of solvent extraction. 3
- (b) What is HPLC? Discuss its instrumentation with the help of diagram. 1+6=7
- (c) What should be the separation characteristics and applications for slightly polar to moderately polar and moderately polar to strongly polar substances in capillary column liquid phases by using phenyl methyl and cyanopropyl phenol solid phases? 4

4. (a) Write notes on the gel permeation chromatography. 5  
 (b) Discuss the choice of detectors in gas chromatography. What type of detectors should we use for organic halogen compounds and inorganic and organic phosphorus compounds? 2+2=4  
 (c) Write any three applications each of gas chromatography and HPLC. 5

### UNIT-III

5. (a) Write a short note on each of the following: 2×2=4  
 (i) Nucleophilic attack on coordinated ligands  
 (ii) Activation of small molecules by complexation  
 (b) Explain with mechanism, hydrogenation of alkene by Wilkinson's catalyst. 6  
 (c) Give the disadvantages of hydroformylation reaction of alkenes using  $\text{Co}_2(\text{CO})_8$  as catalyst. 4
6. (a) Explain with mechanism, hydroformylation reaction of alkene. 6  
 (b) Define homogeneous and heterogeneous catalysis. Write the comparison between homogeneous and heterogeneous catalysts. 1+3=4  
 (c) Write the mechanism of alkene polymerisation by Ziegler-Natta catalyst. 4

### UNIT-IV

7. a) What are ammonio acids and bases? Explain with examples. 4  
 (b) Explain the auto ionisation of liq.  $\text{H}_2\text{S}$  along with reactions. 4  
 (c) Explain the following reactions in liq.  $\text{SO}_2$  with examples: 3×2=6  
 (i) Solvolytic reactions  
 (ii) Acid-base reactions
8. (a) Discuss in detail any of the reactions that take place in liq.  $\text{NH}_3$ . 4  
 (b) How does precipitation reaction take place in liq.  $\text{HF}$ ? 4  
 (c) What is amphoterism? Explain with examples. 6

## UNIT-V

9. (a) Give one method of preparation of  $B_5H_9$  and  $B_4H_{10}$ .  $1\frac{1}{2}+1\frac{1}{2}=3$   
(b) Draw the structure of  $B_4H_{10}$  and  $B_5H_4$ . Mention the different types of bonds present.  $2\frac{1}{2}+2\frac{1}{2}=5$   
(c) How would you prepare cross-linked and chain silicones from  $SiCl_4$  and GR?  $3+3=6$
10. (a) Write short notes on white phosphorus and red phosphorus. Draw their structures.  $3\frac{1}{2}+3\frac{1}{2}=7$   
(b) What are phosphazenes? Give one method of preparation of any phosphazenes. (Reactions only)  $1+1=2$   
(c) Discuss the preparation of carboranes with reactions involved. Draw the structure of ortho- $C_2B_{10}H_{12}$ .  $3+2=5$
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