



M.Sc. 1st Semester
Examination, March-April 2021

CHEMISTRY

Paper - I

Group Theory and Chemistry of Metal Complexes

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 different types of plane of symmetry with example. 6
- (b) Construct multiplication table of C_{3v} point group. 8
- (c) Explain mutual exclusion principle with example. 6

OR

DRG_42_(3)

(Turn Over)

(2)

- (a) Explain conjugacy relation and classes. 6
- (b) The character table of D_3 point group is given below. By direct product method determine the product $E \times E$ and reduce it into the sum of irreducible representations. 8

| D_3 | E | $2C_3$ | $3C_2$ |
|-------|---|--------|--------|
| A_1 | 1 | 1 | 1 |
| A_2 | 1 | 1 | -1 |
| E | 2 | -1 | 0 |

- (c) Evaluate the products σ_v , σ_y , and $C_2\sigma_v$ for a C_{2v} point group. 6

Unit-II

2. (a) Describe ligand group orbitals and symmetry matched metal atomic orbitals appropriate for σ bonding in an octahedral ML_6 complex. 5
- (b) Explain uses of IR Spectra to determine structure of metal carbonyls. 10
- (c) Explain nephelauxetic effect. 5

OR

- (a) Using MOT explain why F^- is a weak ligand. 7
- (b) Describe preparation, properties and structure of $Ni(CO)_4$. 7

(3)

- (c) Write method of preparation and structure of dinitrogen complex. 6

Unit-III

3. (a) Describe spectrophotometric method for the determination of stability constant and composition of a complex. 7
- (b) Explain structure of isopoly and heteropoly acids of W. 8
- (c) Write a short note on silicides. 5

OR

- (a) What is chelate effect? Explain the factors affecting it. 7
- (b) Describe classification of silicates with example. 7
- (c) Write a short note on nitrides. 6

Unit-IV

4. (a) Explain structure of higher boranes. 8
- (b) Explain structure of tetrameric phosphazenes. 6
- (c) Write a short note on trinuclear, tetranuclear metal clusters. 6

OR

- (a) Describe method of preparation and structure of carboranes. 7
- (b) Explain chain catenation and heterocatenation. 7
- (c) Explain structure of borazines. 6