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Total No. of Pages : 02

Total No. of Questions : 09

M.Sc.(Chemistry) (2015 to 2017) (Sem.-2)**SYMMETRY AND GROUP THEORY****Subject Code : MSCH-202****Paper ID : [A2801]****Time : 3 Hrs.****Max. Marks : 100****INSTRUCTIONS TO CANDIDATES :**

1. Attempt any FIVE questions in all, including question no. 1 which is compulsory and selecting one each from units I-IV

Q1. Answer briefly :

- a) What do you understand by the order of a group?
- b) What is meant by the classes of a group?
- c) How the two groups can be isomorphic?
- d) How many types of C_n are present in Benzene molecule?
- e) What is centre of symmetry? Give one example.
- f) What is a non-Abelian group?
- g) What type of dimensionality is represented by letters A and B?
- h) What is Direct Product? Give examples.
- i) Mention the sub-groups in S_4 and D_{2d} .
- j) Do HCl and HCN possess two fold axis of rotation? Give reasons.

UNIT-I

- Q2
- a) Discuss briefly all transformation operations and the classes present in H_2O molecule. (10)
 - b) Discuss the mathematical requirements of a point group. (5)
 - c) What do the areas II and III represent in a character table? (5)

- Q3 a) Discuss the transformation matrix of improper axis of rotation. (10)
- b) How symmetry determines the optical activity in the molecule? Explain. (10)

UNIT-II

- Q4 a) Discuss the standard reduction formula. (5)
- b) What is Orthogonality rule? Explain. (5)
- c) Calculate the IR's from the table given below : (10)

C_{3v}	E	C_3	$3\sigma_v$
Γ_{RR}	21	0	3
Γ_{RR}	15	0	3

- Q5 a) Construct the character table for C_{4v} point group. (10)
- b) What is subscript and superscript rule in Mulliken symbolism? (5)
- c) Differentiate reducible from irreducible representations. (5)

UNIT-III

- Q6 a) Discuss the transformation properties of p orbitals. (10)
- b) Discuss the molecular orbitals involved in the sigma bonding of octahedral complexes with an appropriate example by MOED. (10)
- Q7 a) The selection rules govern the symmetry in cyclisation reactions. Comment. (10)
- b) What symmetry considerations are involved in the dimerisation? Give example. (10)

UNIT-IV

- Q8 a) What are the interelectronic repulsion parameters? (3)
- b) Deduce the microstates for the d^2 -configuration. (10)
- c) Deduce the possible terms for p^2 configuration. (7)
- Q9 a) Explain the Orgel diagrams for the d^2 case in T_d . Give one example. (10)
- b) Explain the Tanabe-Sugano energy level diagram for the d^3 configuration. (10)