Roll No.

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 Cn 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 ₂ Omolecu	iefly all transformation operations and the classes present in H ₂ Omolecule.	
		(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)
	$\begin{array}{ c c c c c }\hline C_{3v} & E & C_3 & 3\sigma_v \\ \hline \Gamma_{RR} & 21 & 0 & 3 \\ \hline \Gamma_{RR} & 15 & 0 & 3 \\ \hline \end{array}$	
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 comwith an appropriate example by MOED.	plexes (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)