CH4208, Midsem-2019, Total Marks 4 + 6 + 10 = 20, Time=90 mins.

Do not write round-about answers.

1. Consider *cis*-$Fe(CO)_4Cl_2$ molecule. Discuss the IR spectroscopy of CO stretching vibrations from symmetry arguments (Hint: you may take a vector corresponding to each C-O bond).

2. (a) Taking a basis of s orbitals on each atom in NH_3 molecule, write down the representation (characters) for all the operations in the point group of this molecule.

   (b) In the $XeOF_4$ molecule, find out the representations (characters) for all the operations, for a basis of four s orbitals, one on each F atom.

3. Write down the point group of *trans*-1,2-dichloroethene. Derive the character table showing the labels of representations, symmetry classes and characters. Also show the transformation properties of all linear, binary (6), cubic (10) as well as rotational vectors (3). Write down all the subgroups.

C_{2v}	E	C_2	σ_v	σ_v'		
A_1	1	1	1	1	z	$z^2; x^2; y^2$
A_2	1	1	−1	−1	R_z	xy
B_1	1	−1	1	−1	$x; R_y$	zx
B_2	1	−1	−1	1	$y; R_x$	yz