# NATIONAL INSTITUTE OF TECHNOLOGY CALICUT

## Department of Chemistry
### Monsoon Semester Test-I, August 2012

### B. Tech. CY 1001 Chemistry

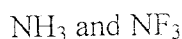Time: 1 hours                                                                      Max. Marks: 20

**Answer All Questions**

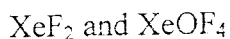### Section – A
### (5 x 2 = 10 Marks)

1. Draw the potential energy diagram for $H_2$ and $He_2$.

2. Explain the hybridization and shape of $ClF_3$ and $NH_2^-$.

3. Arrange the following molecules in the correct order of bond angle and justify your answer. Use ">" sign.

   $NH_3$ and $NF_3$

4. Explain the bonding in magnesium metal with the help of band theory.

5. Draw the Hückel molecular orbitals of 2-methyl-1,3-buatdiene and identify the Lowest Unoccupied Molecular Orbital.

### Section – B
### (2 x 5 = 10 Marks)

6. The first ionization energy (IE) of molecular nitrogen is 1503 kJ/mol, which is higher than that of atomic nitrogen (IE = 1402 kJ/mol). In contrast, the IE of molecular oxygen is 1164 kJ/mol, which is less than that of atomic oxygen (IE = 1314 kJ/mol). On the other hand, the IE of nitric oxide is 894 kJ/mol, which is lower than that of unbounded nitrogen and oxygen atoms. Explain these results by drawing the correct molecular orbital energy level diagrams.

7. (a) Predict and explain the C–C bond length in allylic cation. How do you justify your prediction in relation to π-molecular orbitals?                           (1.5 + 1.5 = 3 Marks)

   (b) Predict the shape and draw the structures clearly showing the lone pairs and double bonds, if any, for the following molecules.

   $XeF_2$ and $XeOF_4$                                                           (2 Marks)