

(2½ Hours)

[ Total Marks :60

- N.B. : (1) All questions are compulsory.  
(2) Figures to the right indicate full marks.

1. (a) Attempt any two of the following:-
- (i) By applying the concept of hybridisation, derive the wave function for hybrid orbitals of methane molecule. 4
  - (ii) What are electron deficient species? On the basis of LCAO-MO concept, explain the bonding in diborane. 4
  - (iii) Discuss the different types of hydrogen bonding with suitable examples. 4
  - (iv) Define magnetic susceptibility. How is it determined by Faraday's method? 4
- (b) Attempt any one of the following:-
- (i) Derive the wave function for hybrid orbitals of  $\text{BeH}_2$  molecule considering only sigma bonding. 4
  - (ii) On the basis of LCAO-MO method, discuss the bonding in  $\text{I}^-$  iodide ion. 4
2. (a) Answer any two of the following:-
- (i) Explain Abelian and non abelian point group with suitable examples. 4
  - (ii) Discuss the criteria for a set of elements to form a group by giving suitable examples. 4
  - (iii) What are irreducible representations? State their characteristics. 4
  - (iv) Discuss the application of Group Theory to explain the sigma and pi bonding in  $\text{AB}_4$  molecule. 4
- (b) Attempt any one of the following:-
- (i) Construct the group multiplication table for  $\text{C}_{2v}$  point group. 4
  - (ii) Derive the matrix representation for identity operation. 4
3. (a) Attempt any two of the following:-
- (i) Discuss the sources, biochemical effects and toxicity of Mercury. 4
  - (ii) Explain the harmful effects of radioactive pollution on human cells. 4
  - (iii) Give the classification and origin of geothermal energy. 4
  - (iv) Elaborate on wind power and hydro power as indirect sources of energy. 4
- (b) Attempt any one of the following:-
- (i) Discuss the toxic effects and treatment of Cadmium poisoning. 4
  - (ii) Write a note on generation of power from nuclear energy. 4

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4. (a) Attempt any **two** of the following:-

- (i) Comment "Co-operative binding of oxygen is observed in haemoglobin molecule". 4
- (ii) Explain the enzymatic reactions catalysed by cytochrome P-450. 4
- (iii) Discuss the composition and the function of transferrin and ferritin. 4
- (iv) Explain the mechanism of action of cis-platin as an anticancer drug. 4

(b) Attempt any **one** of the following:-

- (i) Discuss the conversion of atmospheric nitrogen into ammonia by nitrogenase. 4
- (ii) Explain the various steps in the reaction catalysed by superoxide dismutase. 4

5. Attempt any **four** of the following:-

- (a) Explain ion-dipole and London forces with suitable examples. 4
- (b) State and explain Curie-Weiss Law for antiferromagnetic substances. 4
- (c) Define subgroup. Give the characteristics of subgroup. 4
- (d) Explain symmetry restrictions on the dipole moment in a molecule. 4
- (e) Describe the toxic effects and treatment of poisoning by Copper. 4
- (f) Write a short note on production of electricity from solar energy. 4
- (g) Discuss the structural features and function of haemocyanin. 4
- (h) Explain the reactions of peroxidase using a suitable example. 4

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