

AD-114

April-2015

B.Sc., Sem.-VI

CC-308 : Chemistry  
(Inorganic Chemistry)  
(New)

Seat No. : \_\_\_\_\_

Time : 3 Hours]

[Max. Marks : 70

Instructions : (1) All questions carry equal marks.  
(2) Figures to the right indicate full marks to the sub-question.

1. (a) Calculate the total number of micro-states for  $P^2$  configuration. Draw the pigeon hole diagram for it. Derive all the term symbols for it and arrange them in the increasing order of energy giving reason. 6

OR

Derive the ground state term symbol for the following :

(1) Sc ( $z = 21$ )(2) Ti ( $z = 22$ )(3)  $Cu^+$  ( $z = 29$ )

- (b) Explain the spectrum of  $[Ti(H_2O)_6]^{+3}$ . 8

OR

Explain Orgal diagram of  $d^1 - d^9$  spectrum.

2. (a) What is Hermitian operator ? Explain it. Prove that Eigen functions belonging to different Eigen values of a Hermitian operator are orthogonal. 6

OR

Give Schrodinger wave equation in Polar form. Separate  $\phi$ -equation from it and obtain  $\phi(\phi)$  wave functions as its solution. 8

- (b) Derive the energy equation of particle in three dimensional box. 8

OR

Define Hermitian operator. Prove that Hamiltonian operator is also a Hermitian operator. P.T.O.

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3. (a) Obtain the following secular equation.

$$\begin{vmatrix} H_{11} - ES_{11} & H_{21} - ES_{21} \\ H_{12} - ES_{12} & H_{22} - ES_{22} \end{vmatrix} = 0$$

OR

Calculate the energy of  $E_{\pi}$  for Allylic cation, Allylic anion and allylic free radical.

- (b) What is hybridization? Prove that bond angle between  $Sp^3$  - hybrid orbital is  $109^{\circ} 28'$ .

OR

Explain simple Huckel theory for  $CH_2 = CH_2$  system.

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4. (a) Discuss the structures of  $Fe_3(CO)_{12}$  and  $Cr(CO)_6$ .

OR

Explain the application of IR-spectra in the determination of structures of metal carbonyls.

- (b) Give short account on OMC of Aluminium.

OR

Discuss the structure of Ferrocene.

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5. Answer the following in brief:

- (1) Which factors effects the splitting of the d-orbitals?
- (2) Why d-d transition occurs even though is not allowed?
- (3) Write one rule of d-d transition. ~~10-2-4~~
- (4) Give Hund's rule for deciding electronic constitution of an atom. -
- (5) Give the definition of spectrochemical series.
- (6) Give the bond angle between  $Sp$  hybrid orbitals.
- (7) What is Degeneracy?
- (8) Give the condition of normalization wave function.
- (9) What is backdonation of electron?
- (10) Write the no. of bridge and non-bridge CO groups in  $Ir_4(CO)_{12}$ .
- (11) What is the use of variation method? <sup>12</sup>
- (12) What will be the degeneracy of an energy level  $E = \frac{14h^2}{8ma^2}$ ?
- (13) Write short form of Schrodinger equation. Explain the terms involved in it.
- (14) Give two uses of Huckel theory.

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