Seat No. : 246

E-661

December-2010

Sem - I

Time : 3 Hours] [Max. Marks : 70

1. (a) State and prove variation theorem. 3

(b) Derive the equation for the calculation of energy of an electron with respect to proton taking the case of hydrogen atom. 4

(c) Briefly explain the various quantum numbers and explain why there is no '2d' orbital. 3

(d) Discuss the inner quantum number 'j'. 4

OR

(a) Explain the eigen functions of the position operator and Dirac Delta function. 4

(b) Get the operators of angular momenta in polar coordinate and show that they are Hermitian. 3

(c) Show that $L_z L_- = L_- (L-1)$ and explain each term. 3

(d) Derive the equation for the total angular momentum operation $\hat{J}$ for any electron atom. 4

2. (a) Give an example of orthogonal matrix with explanation. 3

(b) For a point with a coordinate x, y, z obtain the matrix for symmetry operation E and C_n. 4

(c) State the reduction formula used for reducing any reducible representation into its irreducible components. 3

(d) In area IV of the character table where all the squares and binary functions are shown, what do you understand when function x and y are written as (x, y) and not as x, y belonging to one representation. 4

OR

(a) State the condition for an integral, containing two three or more functions, to be non-zero. 3

(b) Explain the significance of every portion of character table. 4

(c) Show that px and py orbitals of nitrogen atom in ammonia, described by the eigen function : $px = R\sin\theta\cos\phi$, $py = R\sin\theta\sin\phi$ provide a basis of the irreducible representation E. 7

3. (a) Discuss Curie law and Curie Weiss law. 7

(b) Explain ferromagnetism and the type of antiferromagnetism. 7

OR

(a) Derive the basic equation for diamagnetic susceptibility. 7

(b) Discuss the importance of Pascal constant and it's utility. 7

4. (a) Discuss the role of iron enzymes in biological system. 4

(b) Explain the importance of trace elements in living system. 3

(c) What is chelation therapy ? Discuss the use of BAL, and aurine tricarboxylic acid in medicine. 4

(d) Explain use of platinum in anticancer drug. 3

OR

(a) Discuss the importance of nitrogen fixation in biological system. 4

(b) Explain the function of Na^{+1} and K^{+1} in living system. 3

(c) Discuss the use of gold in rheumatoid arthritis. 4

(d) Give the biochemical effect of arsenic. 3

5. Answer the following : **(1 mark each)**

(i) The orbital angular momentum of an electron in 'p' orbital is _____

(ii) The term $Y_{l,m(\theta,\varphi)}$ is called as _____

(iii) $L_z = h/2\pi\ (x\ \partial/\partial y - y\ \partial/\partial x)$; True or False

(iv) For functions f and g if we have $\hat{A}(f+g) = \hat{A}f + \hat{A}g$; then $\hat{A}$ is called _____ operator.

(v) When Kronecker delta equals one ?

(vi) The trace of a matrix, trace (A) =

(vii) An electric dipole transition will be allowed with x, y or z polarization if _____

(viii) What will be the character of the matrices of non degenerate or singly degenerate representation under identity operation ?

(ix) How can we cure the deficiency of zinc ion in diabetes and leukaemia ?

(x) What is polycythemia ?

(xi) A diamagnetic substance will have $P < 1$; True or False.

(xii) Which type of magnetic substance gives Curie temperature ?

(xiii) What is heam and haemin ?

(xiv) Give the names of two platinum compounds which possess anticancer activity.