(b) Discuss the combination of the angular momenta and hence explain the CG coefficients for the states with $J_1 = 1$ and $J_2 = \frac{1}{2}$

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2016
(January)

Time : 3 hours

Full Marks : 80

The figures in the right-hand margin indicate marks.

Answer from both the Sections as per direction.

(QUANTUM MECHANICS – I)

Section – A

1. Answer any four of the following :　　4×4 = 16

    (a) Explain the physical interpretation of Hermitian Operators.

    (b) Discuss the properties of unitary transformation of basis vectors.

    (c) Define Schrodinger Picture and explain its properties.

    (d) Explain how orbital angular momentum operator as generators of rotation.

(e) Explain the porperties of CG coefficients.

(f) Obtain the CG coefficients in the case of $J_1 = \frac{1}{2}$ and $J_2 = \frac{1}{2}$.

OR

2. Answer all questions from the following :

2×8 = 16

(a) Define Linear Vector Space.

(b) Explain closure properties of basis set.

(c) Define matrix representation.

(d) Explain the properties of creation operator.

(e) Determine the eigen value of L^2.

(f) What do you mean by raising and lowering operator ?

(g) Define spin angular momentum.

(h) Define explicit matrices of J_z.

Section – B

Answer all questions :

16×4 = 64

3. (a) Define Dirac Delta function and discuss its properties. Explain its applications in quantum mechanics. Explain the orthogonality of eigen vectors.

OR

(b) State and explain expansion theorem. Discuss the operator representation in matrix form.

4. (a) Obtain the equations of motion in both Heisenberg and interaction pictures.

OR

(b) Discuss the operator method in the solution of harmonic oscillator problem.

5. (a) Obtain the commutation relations between the operators L^2, L_x, L_y, L_z. Prove that the operators L^2 and L_z commute.

OR

(b) Derive the expression for L_x, L_y, L_z and L^2 in spherical polar coordinate system.

6. (a) What are Pauli Spin Matrices ? Explain their properties. Obtain the eigen volues and eigen functions of them.

OR