



LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – PHYSICS

SECOND SEMESTER – APRIL 2016

PH 2811 – QUANTUM MECHANICS

(UPTO 11-BATCH)

Date: 25-04-2016

Dept. No.

Max. : 100 Marks

Time: 01:00-04:00

SECTION –A

Answer **all** the questions.

(10 x 2 = 20 Marks)

1. State any two conditions on the wave function.
2. Give any two postulates of quantum mechanics.
3. Establish any two commutation relation between L_x , L_y , and L_z .
4. Define parity operator and find the eigen values.
5. Show that a unitary transformation is a norm conserving transformation.
6. What do you mean by time reversal?
7. Establish any two properties of Pauli matrices.
8. What do you mean by spin orbit interaction?
9. Give the matrix form of J^2 when $j=1$.
10. Obtain the complete Eigen kets for uncoupled and coupled representation of $j_1 = 1$ & $j_2=1/2$.

SECTION –B

Answer any **four** questions.

(4 x 7.5 = 30 Marks)

11. State and prove Ehrenfest theorem.
12. Solve for the eigen value spectrum of a one dimensional quantum harmonic oscillator.
13. Show that the unitary transformation to go from Schrodinger to Heisenberg representation is time evolution.
14. Obtain the C.G. coefficients for addition of angular momenta $j_1=1/2$ and $j_2=1/2$.
15. Explain how degeneracy is lifted in a doubly degenerate state using time independent perturbation theory.

SECTION –C

Answer any **four** questions.

(4 x 12.5 = 50 Marks)

16. Establish the uncertainty principle between any two non-commuting observables.
17. Starting from the radial part of the Schrodinger equation for the hydrogen atom, obtain the eigen values and the eigen functions.
18. Write short notes on conservation laws and their associated symmetries.
19. Represent L^2 in spherical polar coordinates and solve it to get the eigenvalues and the normalized eigen functions.
20. Explain the formation of the hydrogen molecule using vibrational method.

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