PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

MSc DEGREE EXAMINATION DECEMBER 2018
(First Semester)

Branch-PHYSICS

QUANTUM MECHANICS !

Time: Three Hours **Maximum: 75 Marks**

SECTION-A (10 Marks)
Answer ALL questions
ALL questions carry EQUAL marks (10 x 1 = 10)

Choose the correct answer :

1 **Radiation given out by a black body depends on**
(i) nature of the body **(ii) absorbed temperature**
(iii) distance between source and black body (iv) absolute temperature

2 **Find kinetic energy of the photo electron depends on**
(i) velocity of electron **(ii) frequency of incident radiation**
(iii) temperature of the incident radiation (iv) velocity of proton

3 **In which representation wave function is time-dependent and operator time-independent.**
(i) Heisenberg picture **(ii) Dirac picture**
(iii) Schrodinger picture **(iv) Maxwell picture**

4 **When is the product of two hermitian operators, hermitian, if they**
(i) commute **(ii) anticommute**
(iii) non commuting **(iv) none of these**

5 **Indicate the transition probability from m energy level to n energy level in time dependent perturbation theory,**
(i) $E_{m} \sim E_{n}$ / h (h) $E - E$ / n *
(iii) $E_n - E_m$ / h **(iv)** $E_m - E_n$

6 **Indicate the Fermi golden rule of time dependent perturbation theory gives the transitions of**
(i) perturbed Hamiltonian from one stationary state to another per unit time
(ii) unperturbed Hamiltonian from one group of state to another group per unit time
(iii) unperturbed Hamiltonian from one stationary state to another per unit time
(iv) None of these

7 **Find the value of [L x> *"^]-**
(i) i*y **(ii) i/jP$_y$**
(iii) o **(iv) I*²P$_y$**

8 **Name the j_2 matrix for j = 0.**
(i) Unit matrix **(ii) Null matrix**
(iii) Both unit and null matrix **(iv) none of these**

9 **Which of the following represents transmission coefficient?**
(i) transmitted wave intensity relative to an incident wave.
/'ti'v arrinltfiiHp intencitv of 3 transmitted wave

SECTION - B (35 Marks!

Answer ALL Questions

ALL Questions Carry EQUAL Marks (5 x 7 = 35)

11 a **Show that eigen values of a matrix are invariant under similarity transformation.**

OR

b **Obtain the characteristic equation of matrix A =**

$$\begin{matrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{matrix}$$

12 a **Explain Hilbert space.**

OR

b **Solve Shrodinger equation for a linear harmonic oscillator and obtain** $E_n = (n + y\hat{}hco.$

13 a **Analyze about adiabatic approximation.**

OR

b **Describe Harmonic perturbation.**

14 a **Prove $[L_x, L_y] = \backslash hL_z$ and $[L_z, L^2] = 0$.**

OR

b **Determine CG coefficients for addition of orbital and spin angular momentum for electron in P-state.**

15 a **Explain briefly a method of approximation for the case of slowly varying small potential.**

OR

b **Analyze the statement 'W.K. approximation is a link between quantum and classical mechanics.**

SECTION - C (30 Marks)

Answer any THREE Questions

ALL Questions Carry EQUAL Marks (3 x 10 = 30)

16 **Justify a matrix can be diagonalized by a unitary transformation.**

17 **Evaluate the eigen values and eigen functions of linear harmonic oscillator using Schrodinger picture.**

18 **Discuss the first order time dependent perturbation, varying in time leads to emission or absorption in energy.**

19 **Enumerate the matrices for the operators J^2, J_z, J_x and J_y for j = 1**

20 **Analyze how perturbation theory is applied to the degenerate level of system for a time independent perturbation.**

Z-Z-Z END