Avinashilingam Institute for Home Science and Higher Education for Women
(Deemed to be University under Category 'A' by MHRD, Estd. u/s 3 of UGC Act 1956)
Re-accredited with 'A+' Grade by NAAC. Recognised by UGC Under Section 12B
Coimbatore - 641 043, Tamil Nadu, India

Master's Degree Examination – June / July 2021
II Semester

Class : I PG **Time : 3 Hours**
Major : Physics **Max. Marks: 100**

20MPHC07 Quantum Mechanics I

Part A **10 x 1 = 10**
Choose the Correct Answer

1. Debroglie wavelength is equal to
a. h/p b. hp c. p/c d. $\hbar$/p
CO1K1

2. Momentum operator is CO1K2
a. ih/2π DEL b. h c. d/dx d. ix

3. Wave function defines CO2K2
a. probability of identifying particles b. conjugate states
c. Eigen values d. dynamic variability

4. Unitary operators preserve CO2K3
a. vector quantity b. scalar quantity
c. tensor quantity d. mixed tensors only

5. If ax1+bx2=0, vectors x1 and x2 are CO2K3
a. linear dependent b. linearly independent
c. crossed d. isolated

6. Role of linear harmonic oscillator is to link CO3K3
a. Fermions b. Kaons
c. pions d. Bosons

7. Schrodinger equation describes CO4K2
a. frequency of oscillation b. skin depth
c. change of physical quantity overtime d. Debye length

8. The expected phenomena that can happen for a particle falling on Potential barrier is CO4K1
a. tunneling b. reflection
c. tunneling and reflection d. refraction

9. [Lx,Ly]= CO4K1
a. $\hbar L_x$ b. $i\hbar L_x$ c. hL_y d. $i\hbar L_z$

10. Ladder operators are CO5K2
a. J_+ b. J_- c. J_+ and J_- d. J_o

Part B **5 x 6 = 30**

Answer ALL questions

Each answer should not exceed 400 words or two pages

11.a. State and explain de broglie hypothesis. CO1K2

(or)

11.b. Brief about expectation value of dynamical variables. CO1K1

12.a. With suitable examples discuss about Linear operators. CO2K2

(or)

12.b. Outline the features of unitary operators. CO2K2

13.a. Enumerate the properties of linearly independent vectors. CO3K3

(or)

13.b. Mention the properties of unitary transformations. CO3K2

14.a. Deduce time dependent Schrodinger equation CO4 K1

(or)

14.b. Compare the mechanism of infinite depth and square step barrier. CO3K2

15.a. Distinguish between spin angular momentum and generalized angular momentum. CO4K2

(or)

15.b.Obtaineigen values of J^2 and $J_{z.}$ CO5K3

Part C **5 x 12 = 60**

Answer ALL questions

Each answer should not exceed 800 words or four pages

16.a. Obtain steady state solution of Schrodinger's equation. CO1K2

(or)

16.b. State and prove Ehrenfest's theorem. CO1K2

17.a. What are Hermitian operators? List their properties. CO2K1

(or)

17.b. How are Poisson brackets applicable for commutation relations? CO2K3

18.a. Elaborate with examples about Gram Schmidt's orthonormalisation method. CO3K2

(or)

18.b. Discuss matrix theory of harmonic oscillator. CO2K2

19.a. Obtain suitable expression for energyof a particle in a box. CO4K2

(or)

19.b. Arrive at the ground state energy of LHO. CO2K3

20.a. Give an account of CO4K2

(i)Eigen values of J^2 and J_z

(ii)Rotation and angular momenta.

(or)

20.b. Explain the construction of CG coefficients. CO3K2

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