University of Hyderabad School of Physics

M.Sc.-I/IMSc.-III May 13-Jul 6 (2019) Quantum Mechanics

July 5, 2019

MM: 12

FINAL EXAMINATION :: PART-A

[1] Give an example of a potential in one dimension such that its energy spectrum consists of bound states and doubly degenerate continuous energy states only and it does not have non-degenerate continuous energy levels. [3]

[2] For Dirac delta function potential $V(x) = -\gamma \delta(x)$ general solution of Schrodinger equation for E > 0 in regions x < 0 and x > 0 is given by

$$u(x) = \begin{cases} u_1(x), & x < 0 \\ u_2(x), & x < 0 \end{cases}$$

where

$$u_1(x) = A_1 \cos kx + B_1 \sin kx \qquad x < 0$$

$$u_2(x) = A_2 \cos kx + B_2 \sin kx \qquad x > 0$$

Consider a beam incident on a target represented by Dirac delta function potential from the left. Which of the following options is correct for boundary condition for computing reflection and transmission coefficient?

(i)
$$A_1 + iB_1 = 0$$

(ii)
$$A_1 - iA_2 = 0$$

(iii)
$$B_1 + B_2 = 0$$

(iv) None of the above.

If you choose option (iv), write the appropriate boundary condition for this question. [3]

[3] What is the value of spin s of a particle having spin wave function

$$\chi = \begin{pmatrix} 4\\3\\1\\0 \end{pmatrix}.$$

[2]

Your answer for s here: s =

[4] Write the third postulate of quantum mechanics which gives the physical interpretation of eigenvalues and eigenfunctions and of wave function for computation of probabilities.