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Ex/SC/MATH/PG/4.3/A2.8/2022

M. SC. MATHEMATICS EXAMINATION, 2022

(2nd Year, 2nd Semester)

QUANTUM MECHANICS

PAPER – 4.3 (A 2.8)

Time : Two hours

Full Marks : 50

Answer **any five** questions.

5×10

- b) Differential cross-section and total scattering cross-section of the scattering process.
- c) Parity transformation, Charge conjugation
7. Find the differential cross-section using Born Approximation method for the potential

$$U(r) = -U_0, \quad r < a, \\ = 0, \quad r > a$$

1. Find the solutions of the free particle Dirac Equation.
2. Show that the probability density obtained from the Klein-Gordon equation is not positive definite. How is this difficulty overcome?
3. Show that the orbital angular momentum is not conserved for the Dirac particle, but the total angular momentum which includes spin is conserved.
4. If $\psi_1, \psi_2, \psi_3, \psi_4$ be the free particle solutions of the Dirac equation, show that the solutions are orthogonal. Find the normalisation factor by which the wave functions can be made normalised.
5. Use the method of partial waves to obtain the scattering cross-section in terms of the phase shifts.
6. Write short notes on : (**any two**)
 - a) Born Approximation

[Turn over