Mid Semester Quizz

Indranil Chakrabarty

January 2022

Full Marks-15

Time-30 minutes

Instructions: Section A to be attempted by even roll numbers and Section B to be attempted by odd roll numbers.

1 SECTION A :

1. Express σ_x, σ_y and σ_z in the eigen basis of σ_y, σ_z and σ_x respectively. **(9)**

2. Show tensor products of two unitary operators is unitary. **(3)**

3. Find the values of the commutators $[\sigma_x, \sigma_y]$, $[\sigma_y, \sigma_z]$ and $[\sigma_z, \sigma_x]$. **(3)**

2 SECTION B:

1. Calculate all possible tensor products of Pauli matrices: $\sigma_i \otimes \sigma_j$ for $i, j = x, y, z$. **(9)**

2. Suppose A and B are Hermitian, then show that $i[A, B]$ is also Hermitian. **(3)**

3. Prove that two eigen vectors of a Hermitian operators with different eigenvalues are necessarily orthogonal. **(3)**