Assessment 4

Due on 2020-10-14, 23:59 IST.

1. You are given the following Lagrange type stochastic differential equation:
   \[ \text{d}x(t) = \alpha(t) \text{d}t + \beta(t) \text{d}W(t) \]
   \[ \text{d}y(t) = \gamma(t) \text{d}t + \delta(t) \text{d}W(t) \]
   The corresponding Fokker-Planck equation for the probability density \( f(x,y,t) \) will take the form:
   \[ \frac{\partial f(x,y,t)}{\partial t} = \ldots \]
   - None of the above
   - the power is incorrect

2. Given that \( \hat{a}^\dagger \hat{a} = 1 \) and \( \hat{a}^\dagger \hat{a} = 0 \), which of the following holds?
   \[ \hat{a} \hat{a}^\dagger = \hat{a}^\dagger \hat{a} \]
   - \( \hat{a} \hat{a}^\dagger = \hat{a}^\dagger \hat{a} \)
   - \( \hat{a} \hat{a}^\dagger = \hat{a}^\dagger \hat{a} = 0 \)
   - None of the above
   - the power is incorrect

3. \[ \int \text{d}x \int \text{d}y \] where the integration is over a complete set of \( x \) states equals:
   - The identity operator
   - \( \ldots \)
   - None of the above
   - the power is incorrect

4. The expression \( [\hat{a}, \hat{a}^\dagger] \) represents:
   - The probability of a quantum system in state \( |\psi\rangle \) to move to state \( |\phi\rangle \)
   - The transition amplitude of a quantum system in state \( |\psi\rangle \) to move to state \( |\phi\rangle \)
   - The transition probability of a quantum system in state \( |\psi\rangle \) to move to state \( |\phi\rangle \)
   - None of the above
   - the power is incorrect

5. The Lagrangian of a particle moving in a potential \( V(x) \) is given by:
   \[ \{ \text{Lagrangian} \} \]
   - None of the above
   - the power is incorrect

6. You are given that \( \{ q^a \} \) is an eigenstate of the momentum operator \( \hat{p} \) for a single non-relativistic free particle with the Hamiltonian \( \hat{H} = \hat{p}^2/2m \). The expression \( \{ q^a \}, \{ q^a \} \) evaluates to (Use the inner product \( \langle q^a | q^b \rangle = \delta_{ab} \))
   - \( \langle q^a | q^b \rangle = \delta_{ab} \)
   - \( \frac{L}{2m} \) \( \hat{p} \hat{p} \)
   - None of the above
   - the power is incorrect

7. \[ \int_{-\infty}^{\infty} \text{d}x \text{e}^{-x^2} \] evaluates to:
   - \( \ldots \)
   - None of the above
   - the power is incorrect

8. The Lagrangian of a harmonic oscillator is \( \frac{1}{2} m \dot{x}^2 + \frac{1}{2} k x^2 \). The corresponding Euler-Lagrange equation is:
   - \( m \ddot{x} + k x = 0 \)
   - \( m \ddot{y} + k y = 0 \)
   - None of the above
   - the power is incorrect

9. \[ \int \text{d}x \text{d}y \left( \delta(x - y) \right) \] is equal to:
   - \( \ldots \)
   - None of the above
   - the power is incorrect

10. The probability density function of a Gaussian distribution \( \phi(\sigma = \frac{1}{\sqrt{2\pi} \sigma}) \) is:
    - \( \phi(\sigma = \frac{1}{\sqrt{2\pi} \sigma}) \)
    - \( \phi(\sigma = \frac{1}{\sqrt{2\pi} \sigma}) \)
    - None of the above
    - the power is incorrect

11. The characteristic function is:
    - \( \ldots \)
    - None of the above
    - the power is incorrect

12. \( \ldots \)