Course: BSO 203 Instructor: S. Raychaudhuri

SESSION 2002-2003, SEMESTER I

QUIZ IV

Answer the questions by putting a tic mark in the circle — thus (✓)— adjacent to the correct (or most fundamental) alternative. No credit will be given if more than one alternative is marked. (5× **1**)

1. Wave-packets spread out in space as time increases because
   (a) ◯ the area under the curve must remain unity.
   (b) (✓) the dispersion relation is nonlinear.
   (c) ◯ the form is Gaussian only at $t = 0$.
   (d) ◯ the uncertainty product increases with time.

2. Classical mechanics is deterministic because
   (a) ◯ there is no wave-particle duality.
   (b) ◯ the particle trajectories are defined as functions of $\vec{x}$ and t.
   (c) ◯ it is valid in the limit $\hbar \to 0$.
   (d) (✓) the uncertainties in position and momentum are negligible for macrosystems.

3. The Schrödinger equation cannot be derived because
   (a) ◯ it is valid only in the nonrelativistic case.
   (b) (✓) it is a fundamental law describing the dynamical behaviour of microscopic systems.
   (c) ◯ operator equivalences have to be postulated in the presence of a potential energy.
   (d) ◯ it has to be assumed that the wavefunction is square-integrable.

4. The physical meaning of an expectation value is
   (a) ◯ a weighted mean of eigenvalues of the operator.
   (b) (✓) it is an average value of measurements performed on an ensemble of identically-prepared systems.
   (c) ◯ it is an integral over all space of the probability of the operator acting on the wavefunction.
   (d) ◯ it is a measure of the overlap of the wavefunction with all the eigenfunctions.

5. The idea which distinguishes the Copenhagen interpretation of quantum mechanics is that
   (a) ◯ the wavefunction collapses on measurement.
   (b) ◯ the wavefunction is not a measurable object.
   (c) ◯ the wavefunction is a probability amplitude.
   (d) (✓) the wavefunction has objective reality.