Queen Mary
University of London

MAS348   From Classical Dynamics to Quantum Theory

Key Objectives (preliminary, Sept. 2007)   **Fall 2007**

The following topics are intended as a list of objectives to be mastered in order to be reasonably sure of passing the examination in quantum theory with a reasonable grade.

1. **Classical Hamiltonian mechanics:** Hamiltonian, Newton's and Hamilton's equations, Poisson bracket and its properties, rate of change of dynamical variables, conserved dynamical variables, angular momentum, graphical discussion of possible types of motion of point particles in given potentials

2. **Rise of quantum mechanics:** Definition of different types of Schrödinger equations, wave functions and their properties, boundary conditions, stationary states, quantisation rules classical to quantum theory

3. **Mathematical foundations of QT:** Vector spaces, scalar product and its properties, orthogonal and orthonormal basis, linear operators and their properties, Hermitian conjugate, Hermitian operators, properties of eigenvalues and eigenfunctions of Hermitian operators, expectation and standard deviation for operators, compatibility of operators, commutators and their properties, mathematical statement of uncertainty principle

4. **Applications of QT:** Motion in one dimension – potential step, tunnel effect, different types of infinite potential wells

5. **Angular momentum and its quantisation:** Spherically symmetric potentials, eigenvalue equations, ladder operators, Hydrogen atom

The **rubric** will state: The duration of the examination is two hours. You should attempt all questions. Marks awarded are shown next to the questions. Calculators are **not** permitted in this examination.