Exam Administration:
The exam will consist of two sections, each with three questions. From each section you can select two questions out of the three. You will have three hours to work on the solutions. You are allowed one textbook of your choice, one math reference, and a calculator.

Exam Topics:
The PhD qualifying exam will be at the level of the textbooks by Liboff, Griffith, Shankar, etc.

The exam questions will be on the following topics:

1. Principles of Quantum Mechanics like the superposition principle, definition of a quantum state, the probability interpretation, discrete and continuous symmetries, commuting operators and the uncertainty relation, etc.

2. The time-dependent and time-independent Schrödinger equation, bound state and unbound state exact solutions in 1, 2, and 3 dimensions, e.g. Square Well, Rectangular Box, Square Step, Harmonic Oscillator, Hydrogen atom, periodic potentials, delta-function potentials, etc.

3. Solving the Schrödinger equation, approximately
   a. Variational method
   b. WKB approximation
   c. Time-independent perturbation theory (degenerate and nondegenerate)
   d. Time-dependent perturbation theory

4. Angular Momentum
   a. SU(2), spin-1/2
   b. Addition of Angular Momenta and selection rules

5. Scattering
   a. Fermi's golden rule and quantum state transition rates, e.g. ionization of Hydrogen, Rutherford scattering.
   b. Familiarity with the non-relativistic scattering cross sections of half-integer spin particles, e.g. symmetry constraints on the 2x2 scattering matrix, polarization, etc.

Note that some of these topics may or may not be covered in the books mentioned above.