Introduction to superconductivity

1) Definition of a phase transition.
2) Superconductivity as a phase transition of 2\textsuperscript{nd} order type. Why 2\textsuperscript{nd} order?
3) Analysis of Thermodynamic quantities. What happens at the phase transition?
4) Analysis of transport properties: resistivity, tunnel effect.
5) Analysis of the behavior of a superconductor in a magnetic field: Meissner effect.
   - Derivation of the properties of an ideal Diamagnet using the Maxwell equations.
   - Concept of critical magnetic field.
   - Type I and Type II superconductors
6) First attempts to understand superconductivity: London-equations. The simplest one is:
   \[ x < 0 \quad \text{normal conductor} \quad x > 0 \quad \text{superconductor} \]
   with the introduction of Quantum Mechanics, derivation of the Quantumflux in a superconductor ring
7) Phenomenological model 2: Ginzburg-Landau-Theory concept of order parameter
8*) Microscopic theory Concept of cooper Pairs BCS (Bardeen-Cooper-Schrieffer)
9*) Tunnel effect Josephson effect

Literature

Articles (Wohlleben effect)