Lecture 1:

1. In the GL free energy, why isn't a cubic term in the order parameter included? Why are higher order terms neglected?

2. Starting from Equation 6 in the text, work out the details and obtain equations 7 and 8. Further simplify these to obtain the expression for the energy $\frac{1}{2m^*}(\hbar^2\overrightarrow{\nabla}(|\psi|)^2 + (\hbar\overrightarrow{\nabla}\varphi - \frac{q\overrightarrow{A}}{c})^2|\psi|^2)$.

Lecture 2:

3. Start from equations 10 and 11 for α and β. Substituting for the temperature dependence of the penetration depth and the critical field, obtain equations 12 and 13.

Lecture 3:

4. Using the steps detailed in the text, start from equation 17 and work out all the details to finally obtain the two GL equation stated in equations 28 and 29.

5. Calculate the value of the GL coherence length at zero temperature for a superconductor whose critical field is 1000 kOe and the penetration depth is 5000 Å.

Lecture 4:

6. Substitute $f = \tanh(\frac{\kappa x}{\sqrt{2}})$ in equation 49 and check that it is a solution.

Lecture 5:

7. Draw the schematic variation of the magnetic field inside an infinite slab of thickness d in an applied magnetic field. Sketch also the variation of the order parameter inside the slab.

8. Explain fluxoid quantisation. Under what conditions does this amount to flux quantisation?

Lecture 6:

9. A superconductor which has a penetration depth of 2000 Å is made into a thin film of thickness 1000 Å. It is placed in magnetic field of 2000 Oe parallel to the plane of the film. What is the Meissner fraction for this film?

Lecture 7:

10. Draw the schematic variation of the magnetic field and the order parameter inside a vortex in a superconductor.