

**TFY4245/FY8917 Solid State Physics, Advanced Course**

NTNU

**Problemset 7**

Institutt for fysikk

**Problem 1**

(a) Prove that a Landau free energy would be unbounded from below if the Taylor-expansion stops at an odd-order term.

(b) Consider a Landau free energy including quadratic, cubic, and quartic terms, and prove that the cubic term forces the transition to the disordered state to be first-order.

**Problem 2**

Compute the relative dielectric constant at temperatures above the ferroelectric transition temperature  $T_c$  for a Landau free energy:

$$F = -EP + g_0 + \frac{1}{2}g_2P^2 + \frac{1}{4}g_4P^4. \quad (1)$$

In obtaining the equilibrium polarization  $P$ , you may neglect the contribution from  $P^4$  compared to  $P^2$ .