

In the name of God

Department of Physics
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STATISTICAL FIELD THEORY AND CRITICAL PHENOMENA

Exercise Set 5

(Due Date: 1403/08/20)

1. Tricritical phase transition: According to the sixth order Landau theory, suppose that

$$\mathcal{L} = -hm + \frac{1}{2}am + \frac{1}{4}bm^4 + \frac{1}{6}cm^6$$

where $a = a(t)$, $b = b(t)$ and $c = c(t)$. In order to have physical value for m , deduce the necessary properties of a, b, c and their temperature dependancies. Finally for proper value of multipliers determine the m 's for them the landau free energy has extremums.

2. Exercises no. 3.1, 3.3, 5.2, 5.3, 6.4, 7.1 Goldenfeld.
3. Incorporating Gaussian approximation in the Landau theory in d -Dimension for n -fields according to:

$$L[\phi] = \int d^d r [a_0 + a_2(t)\phi^2 + a_4\phi^4 + (\nabla\phi)^2]$$

determine all of scaling exponents and derive the C_V for $T > T_c$ and $T < T_c$. Also, show that in the Fourier space, the partition function is given by:

$$Z = \int \mathcal{D}[\phi] e^{-\frac{1}{2} \int d^d k (\xi^{-2} + k^2) \psi(-k) \psi(k)}$$

here $\xi^{-2} \equiv a_2(t)$ for $T > T_c$, $\xi^{-2} \equiv -2a_2(t)$ for $T < T_c$ and $\phi(r) = \phi_0 + \psi(r)$

4. Exercises no. 2.2, 2.3, Kardar

Good luck, Movahed
