



**Arab Academy for Science & Technology
and Maritime Transport – Cairo Branch
College of Engineering & technology
Electronics & Communication Engineering Department**



EC311 – Electronic Materials

Problem Set No.7: Revision

Duration: Week# 7

Physical Constants:

Avogadro's number (N_A) = 6.02×10^{23} atoms/mol

$\epsilon_0 = 8.85 \times 10^{-12}$ F/m

$K = 1.38 \times 10^{-23}$ J/°K

P1) Consider a system of non – interacting dipoles, which are confined to two possible orientations relative to an applied field E: either parallel or anti parallel.

Show that at temperature T the average polarizability is equal to $\frac{p_o^2}{KT}$, which differ by a factor of 3 from the formula of Langevin function)

P2) Draw the layout of several dipoles when:

- a) The average dipole moment is zero.
- b) The average dipole moment is p_o .

P3) The permanent dipole moment for a dielectric material is 4.5 Debye, find the dipolar polarizability at room temperature... 1 Debye = 10^{-21} c.m.

P4) Put (✓) on the right statement or (X) on the wrong statement. Correct the wrong ones:

(a) The water molecule has permanent moment even in the absence of the electric field. ()

(b) The electric susceptibility has the units of F/m. ()

(c) The effect of the external electric field is to align the electric dipoles, whereas the effect of temperature is to randomize the direction of the dipoles. ()