



COLLEGE OF ENGINEERING & TECHNOLOGY

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Course : Electronic Materials
Course Code : EC311

Sheet 3

Problem on Dielectric Materials

1. Consider air, which is composed of N_2 and O_2 , the dielectric constant k of air is 1.00059. At standard temperature and pressure, the no. of molecules per cubic meter in air is equal to $2.7 \cdot 10^{25} \text{ m}^{-3}$. Find the weighted average of their polarization.
2. A material density 10 gm/cm^3 and molecular weight is 5, has $k=4$ determine α .
3. In case of liquid and solids, the dipole moment is defined as $p = \alpha E_{loc}$ where,
 $E_{loc} = E_0 + E_1 + E_2 + E_3$.
Get an expression for the local field for the following cases:
 - (a) Thin slab $C \gg a$.
 - (b) Thin slab $C \ll a$.
 - (c) Sphere.
 - (d) Thin slab with short circuit.
4. For a Hydrogen atom in an external electric field normal to the plane of the orbit, show that $\alpha = a_H^3$ where a_H is the radius of the unperturbed orbit.
5. Show that the polarizability of the conducting metallic sphere of radius a is
$$\alpha = a^3 \quad (\text{C.G})$$
$$\alpha = 4\pi\epsilon_0 a^3 \quad (\text{S.I})$$