FOURTH SEMESTER

B.Tech. [ENGINEERING PHYSICS]

MID SEMESTER EXAMINATION

(March- 2019)

EP-202: CONDENSED MATTER PHYSICS

Time: 1:30 Hours   Max. Marks: 30

Note :	Answer ALL questions. Assume suitable missing data, if any.

1.(a). What are Cooper pairs? Describe formation of cooper pair in superconductor. [3]

   (b). How does the energy gap in superconductors differ from the energy gap in insulators? How does it vary with temperature for superconductors? [3]

2. (a). The penetration depth of Sn at absolute zero is 3.4×10^{-6} cm. Find the value of penetration depth and super electron density at 3.5 K. Transition temperature of Sn is 3.72 K. [3]

   (b). Define superconductivity? Explain the phenomenon behind the process of magnetic levitation and Maglev vehicles. [3]

3.(a). An atom of polarizability, α is placed in a homogeneous field E. Show that the stored energy stored in a polarized atom is equal to $E^2(\alpha/2)$. [3]

   (b). Find the polarizability of CO_2, if the susceptibility is 0.985×10^{-3}. Density of carbon dioxide is 1.977 kg/m^2. [3]

4. What is Lorentz field? Show that the Lorentz field for 3-dimentional elemental solid is given by; $E_L = E + \frac{\gamma P}{\varepsilon_0}$, Where E_L, E, γ and P are Lorentz filed, external field, internal field coefficient and polarization. [6]

5. *Explain:* (a) Isotope effect in superconductors [1.5×4=6]

                (b) Type-II superconductor   (c) Dielectric constant in ac field.

                (d) Draw frequency vs polarizability (real and imaginary component) plot for all polarization and show the individual frequency range.