Department of Humanities and Sciences
National Institute of Technology Goa
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Subject: Material Science **Minor-II** **Time: 45 minutes**
Course Code: PH150 **Max Marks: 10**

Answerer all the questions

1. Calculate the polarization of a $BaTiO_3$ crystal. The shift of the titanium ion from the body centre is 0.06 Å. The oxygen anions of the side faces shift by 0.06 Å, while the oxygen anions of the top and bottom faces shift by 0.08 Å, all in a direction opposite to that of the titanium ion. 1.5 M

2. The shift of the electron cloud with respect to the nucleus of a helium atom when a field of 10^5 V m^{-1} is applied is (α_e for He = 0.18×10^{-40} F m^2) 1.5 M

3. If the electronic polarization of W is 4×10^{-7} C m^{-2}, the average displacement of the electrons relative to the nucleus is (W : at.no. 74, BCC, a = 3.16 Å) 1.5 M

4. The saturation magnetization of BCC iron is 1750 kA m^{-1}. Calculate the net magnetic moment per iron atom in the crystal. 1.5 M

5. Show that, for a perfectly diamagnetic material, $M = -H$, $\chi = -1$ and $B = 0$. 2 M

6. The susceptibility of paramagnetic $FeCl_3$ is 3.7×10^{-3} at 27 °C. What will be the value of its relative permeability at 200 °K and 500 °K 1 M

7. An electron in an atom of hydrogen revolves in an orbit of radius 0.51 Å. Calculate the change in magnetic moment for this electron if a magnetic field of induction 2 T acts at right angles to the plane of the orbit. 1 M