Module 6 Magnetism and Magnetic Ceramics

1. A nonmagnetic oxide consists of a ferromagnetic oxide in form of spherical precipitates, averaging 10 nm in diameter. The precipitates form 2% by volume of the alloy. Ferromagnetic oxide has a saturation magnetization of 1.4×10^6 Am^{-1} and each precipitate is a single domain acting as a strong dipole which responds to any external field as a paramagnetic dipole. The effect is called 'Superparamagnetism'. Calculate the susceptibility of the mixture at 300 K. Consider only the orbital contribution and Curie constant is equal to $\frac{N\mu_m{}^2\mu_o}{3k_B}$.

2. Calculate the Mn^{2+} doping level to design a manganese (Mn^{2+}) substituted ferrite based cubic structured ferrimagnetic material that has a saturation magnetization of 5.25×10^5 A/m. The unit cell parameter of the resulting ferrite can be taken as 0.839 nm. The oxygen remains in stoichiometric amount after the substitution. Atomic numbers of Fe and Mn are 26 and 25 respectively.

3. Understand the susceptibility vs temperature plots for various magnetic materials and understand them.