SARDAR VALLABHBHAI NATIONAL INSTITUTE OF TECHNOLOGY, SURAT-395 007

Assignment-Unit 4, May-2020

B. Tech. II (Div. A to Div. F) PH 113 S2: Physics of Materials and Nuclei

Instructions*: 1. All questions are compulsory*
2. ***Submit before 31st May 2020***

Q.1 Write the answers of following questions.

1. Define: Magnetic fields, Magnetic Induction (B), Magnetic Moment (μ_m), Magnetic Field Intensity (H), Magnetisation (M),Permeability, Magnetic susceptibility (χ)
2. Discuss the properties and effect of external fields on the dia, para and ferromagnetic materials.
3. What are ferromagnetic domains? Draw B-H curve for ferromagnetic material and identify retentivity and coercive fields on the curve. What is the energy loss per cycle?
4. Distinguish between soft and hard magnetic materials.
5. Distinguish between Anti-ferro and Ferri magnetic materials.
6. A magnetic material has a magnetisation(M) of 3400Am^{-1} and magnetic flux density (B) of 0.0048 Wbm^{-2}. Calculate the magnetic field strength (H) and the relative permeability of the material.
7. A magnetic field strength of 2×10^5 Am^{-1} is applied to paramagnetic material with relative permeability of 1.01. Calculate the value of B and M.
8. What are the assumptions introduced by Drude-Lorentz to explain classical free electron theory of metals? Discuss the achievements and failures of this model.
9. State Wiedmann-franz Law. Deduce this law using the results of classical free electron theory.
10. If Widemann-Franz law is valid under quantum mechanical treatment, compute the electrical resistivity of copper at 20 ^{0}C if the thermal conductivity at this temperature is 380 W m^{-1} K^{-1}.
11. A copper wire of length 0.5 meter and diameter 0.3 mm has a resistance 0.12 Ω at 20^{o}C. If the thermal conductivity of copper at 20^{o}C is 390 W m^{-1} K^{-1}, calculate Lorentz number. Compare this value with the value predicted by classical free electron theory.
12. What is Superconductivity? Give an elementary account of superconductivity.
13. Write a short note on Meissner Effect.
14. Explain Type I and II superconductors. Also briefly discuss the important property changes
    during the transition.
15. For a specimen of V_3Ga, the critical fields are respectively 1.4×10^5 and 4.2×10^5 A/m for14K and 13 K. Calculate the transition temperature and critical fields at 0 K and 4.2 K.