Engineering Physics (BAS101)
List of Important Questions

UNIT-5 : SUPERCONDUCTORS & NANOMATERIALS

|| Short Answer Type Questions ||

1. What is superconductivity phenomenon in superconductors?
2. What are superconductors? Write their properties and uses.
3. What is persistent current? Explain its effect on superconductor.
4. What are High T_c superconductors? Give some examples.
5. Differentiate between top-down and bottom-up approach in nanotechnology.

|| Long Answer Type Questions ||

1. What do you understand by superconductivity? Explain How the critical magnetic field depends on temperature of superconductor?
2. What is a superconductor? Explain the effect of temperature and critical current on the state of superconductivity of a superconductor.
3. What is Meissner's effect? Describe that diamagnetism is a more fundamental property than perfect conductivity for a superconductor.

OR

Explain Meissner's effect. Show that zero resistivity and perfect diamagnetism are two essential but independent properties of superconductors.

OR

Explain flux exclusion property of superconductors. Show that a superconductor behaves as a perfect diamagnetic substance.

4. Differentiate between type–I and type-II superconductor with examples. Give properties and uses.
5. What is quantum confinement? Distinguish between quantum dot, quantum wire and quantum well.
6. What are nanomaterials? Explain the chemical vapor deposition (CVD) method to synthesize the nanomaterials. Discuss its importance and limitations.
7. Explain the Sol Gel method to synthesize the nanomateials with the help of suitable diagram. Give its advantages and disadvantages.

|| Numerical Problems ||

1. The critical magnetic field for Niobium as superconductor is 7.616 and 4.284 mA/m at 6K and 8K respectively. Calculate the transition temperature of the element and critical filed at 0K.
2. The critical magnetic field for Niobium as superconductor is 1.0×10^5 amp/m at 8 K and 2.0×10^5 amp/m at absolute zero. Find the transition temperature of the element.
3. The transition temperature for lead is 7.26 K. The maximum critical field for the material is $8x10^5$ A/m. Lead has to use as a superconductor subjected to a magnetic field of $4x10^4$ A/m. What precaution will have to be taken?
4. How much current can a lead wire, 2.0 mm in diameter, carry in its superconducting state at 4.2K? Given B_C (4.2K) = 0.0548 Tesla.
5. Calculate the critical current which can flow through a long thin super conducting wire of diameter 1 mm. The critical magnetic field is 7.9×103 Amp m^{-1}.
6. Calculate the critical current and current density for a wire of a lead having a diameter of 1 mm at 4.2 K. The critical temperature for lead is 7.18 K and $H = 6.5 \times 10^4$ A m^{-1}.
7. Lead has a superconducting transition temperature of 7.26 K. If initial field at 0 K is 50×10^3 Am^{-1}, calculate the critical field at 6 K. If the lead is in the form of a wire with diameter 1.00 mm, then calculate the critical current it can carry.