Kurdistan Regional Government Iraq
Ministry of Higher Education & Scientific Research
Salahaddin University –Erbil
College of Basic Education
Department : General Science

Module : Superconductor
Stage : fourth ----------
Round:----------
Time : 90 min

Exams
16-4-2023

Q1 : A- Compare between type one and type two superconductor. **10 Marks**

B- Explain Meissner effect. **5 Marks**

Q2 A- B- Explain Temperature dependence of the penetration depth. **(8+ 10) Marks**

B- If the magnetic field at zero kelvin 30 Tesla and London penetrate depth 30 nm x is the distance for H to fall from H(0) to H(0)/e have value of 25 nm, determine magnetic field.

Q3: Multiple Choice Questions (Choose the correct answer). **15 Marks**

1- **heat capacity of superconducting state is less than that in the normal state at**

($A-\quad T < T_C$ **B-** $T > T_C$ **C -** $T = T_C$**)**

2- **Critical current density decreases with**

(Decreasing penetrate depth B- Increasing penetrate depth C- independence of penetrate depth).

3- **If atoms mass for isotope atoms is 2 at critical temperature of 15 kelvin if atomic mass is 1.125 critical temperature is (A-13.8 B- 20 C- 47)) kelvin**

4- **Penetrate depth increases below critical temperature with**

(A-increasing temperature B- decreasing temperature C- independent on temperature).

5- **In phonon scattering as temperature decrease**

(A- **Scattering Probability increase and mobility decrease** B- **Scattering Probability and mobility increase** both **decrease** C- **Scattering Probability decrease and mobility increase**)

Best wishes

Lecture\ Instructor: Dr Abbas H Rostam

Signature

Date :16 /4/2023

Kurdistan Regional Government Iraq
Ministry of Higher Education & Scientific Research
Salahaddin University –Erbil
College of Basic Education
Department : General Science

Module : Superconductor
Stage : fourth
Round:-first
Time : 2 hours

Exams: second semester
2-5-2023

Q1 : A- Compare between superconducting and normal states only five. **8 Marks**

B- Write four medical application of superconductors **8 Marks**

Q2: A-Explain microscopic theory of superconductivity (cooper pairing). **8 Marks**

B- Explain Entropy in superconductor **4 Marks**

Q3: A- London penetration depth for Niobium (Nb) at (4, 6) kelvin is (478 *and* 519) nm Respectively. Calculate critical temperature and penertsate depth at zero kelvin. **10 Marks**

B- Calculate the number of the super electron and normal electron at $T = \frac{2}{3}T_C$ **6 M arks**

Q4: A- Multiple Choice Questions (Choose the correct answer). **10 Marks**

1- heat capacity of superconducting state is less than that in the normal state at

($A-$ $T < T_C$ B- $T > T_C$ C - $T = T_C$)

2- .If $\lambda_0 = 0.5\lambda$ the number of super electron is equal

(A- 2 B- 4 C- 0.25) total electrons

3- Electrons in cooper pairing is

(A – fermions in the same states B- Bosons in the same states C- Bosons in the difference states)

4- In phonon scattering as temperature decrease

(B- Scattering Probability increase and mobility decrease B- Scattering Probability and mobility increase both decrease C- Scattering Probability decrease and mobility increase)

5- Minimum of magnetic field of superconductor at.

(A- $0 < Tc < T$ B- Tc C- zero) Kelven

B- Write the main advantages of Maglev transportation systems. **6 Marks**

Best wishes

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Date :2 /5/2023

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Ministry of Higher Education & Scientific Research
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College of Basic Education
Department : General Science

Module : Superconductor
Stage : fourth
Round:-second
Time : 2 hours

Exams: second semester
27-5-2023

Q1 : From (A and B) answer only one from them

A- Compare between penetrate depth at zero kelvin and critical temperature. 6 Marks

B-: If magnetic field at zero kelvin is 30 $Tesla$ London penetrate depth 40 $nm\ and$ x is the distance for H to fall from H(0) to H(0)/e has value of 25 nm

Determine magnetic fields. 6 Marks

C – Find the critical current density of the Vanadium (V) wire of radius 10 mm at 3 k if Critical temperature is 5.4 kelvin $B_C = 141\ mT$ =. at zero kelvin 8 Marks

Q2: A -Explain Two fluid model of superconductor. 8 Marks

B- Application in transportation sector 12 M arks

Q3: Multiple Choice Questions (Choose the correct answer). 14 Marks

1- MRI magnets

(A- Successful of HTS B- Minor for LTH C - Successful of LTS)

2- At $0 < T < T_C$ of superconductor

($A - n_n$ and n_s increase B- n_n increase and n_s decrease C-n_n decrease and n_s increase).

3- Type 1 superconductor

(A- Coherence length very small than penetration depth B- Coherence length equal penetration depth C- Coherence length very large than penetration depth

4- In all superconductors, the entropy

(A-decrease B-increase C- constant) on cooling below the critical temperature Tc).

5- All the electrons are paired at (A- zero B- Tc C- $0 < Tc < T$) Kelvin

6- Penetration depth decrease when temperature is

(A- from zero to Tc B- from Tc to zero C- Tc).

7- The magnetic field thus decays with distance into the superconductor as

(A- Exponentially B- linearly C- not decay)

Q4 : Draw the graph and write equation for these statements (answer only three). 12 Marks

1- **Heat capacity jump at critical temperature and exponential decay for $T < Tc$**
2- **Type 2 superconductor**
3- **Temperature dependence of the BCS gap function**
4- **Zero resistivity of superconductor.**

Best wishes

Lecture\ Instructor: Dr Abbas H Rostam

Signature Date : /6/2023