SARDAR PATEL UNIVERSITY
5th Semester B. Sc. EXAMINATION (Under CBCS)
Friday, 15th November 2019
Time 10:00 am to 1:00 pm
Subject Code: PHYSICS [USO5CPHY03]

(Solid State Physics)

N.B: (i) All the symbols have their usual meanings.

(ii) Figures at the right side of questions indicate full marks.

Total Marks: 70

Q-1   Choose the correct option for the following questions.   [10]

(1)   Electrons are _____ penetrating than X-rays.

(a) more   (b) less

(c) equally   (d) none of above

(2)   In X-ray diffraction transmission Laue method _____ pattern is obtain.

(a) Elliptical   (b) hyperbolic

(c) parabolic   (d) circular

(3)   In _____ , the distance of each of the points from the origin preserves the interplanar spacing of that stack of parallel planes.

(a) d-spacing   (b) k-spacing

(c) h-spacing   (d) none of above

(4)   The ratio of thermal conductivity to electrical conductivity is _____ to the temperature for a large number of metals.

(a) equal   (b) proportional

(c) inversely proportional   (d) exponentially proportional

(5)   The temperature at which a conductor becomes a superconductor is called __ .

(a) superconducting temperature   (b) Curie temperature

(c) Ohm's temperature   (d) transition temperature

(6)   When a current is passed through a conductor having resistance R, then heat produced is equal to _____.

(a) I^2R (b) I^2Rt

(c) IR   (d) RV

(7)   The increase in the electrical conductivity of photoconductor is due to the production of electron-hole pairs by the absorbed _____.

(a) phonons   (b) photons

(c) neutrons   (d) electrons

(8)   If the frequency of incident light increases, stopping potential_____.

(a) increases   (b) decreases

(c) does not change   (d) become zero

(9)   In _____ , the amount of electrical current flowing between a sample tip and a surface is measured.

(a) Scanning Tunneling Microscope (b) Atomic Force Microscope

(c) Magnetic Force Microscope   (d) Transmission Electron Microscope

(10)   Any material engineered at nano-scale to perform a specific task is called

_____.

(a) nano-scale biostructure   (b) smart material

(c) self healing structure   (d) self assembled

Q-2 **Answer any ten questions in brief.**   [20]

    (1) What is X-ray crystallography? Enlist properties of X-ray.

    (2) State Bragg's law.

    (3) Enlist primitive vectors of the reciprocal lattice.

    (4) What is Meissner effect?

    (5) Define Drift velocity and derive the equation for electrical conductivity.

    (6) Why soft conductors are not so useful?

    (7) Define Accepter levels and donor levels.

    (8) What is Peltier effect?

    (9) What is interband transition?

    (10) State Moore's first law with necessary graph.

    (11) Give the basic idea of working of all types scanning probe instruments.

    (12) Why ordinary light cannot be used in nanoscale lithography?

Q-3 **(A)** Write a detailed note on X-ray diffraction rotating crystal method.   [06]

    (B) Enlist properties of reciprocal lattice.   [04]

                               OR

Q-3 **(A)** Write a note on geometrical construction of reciprocal lattice.   [06]

    (B) Explain relation between σ_{hkl} and crystallographic axis.   [04]

Q-4 **(A)** Define the terms: Superconductor and Superconductivity. Explain Type I and II   [06]
superconductors.

    (B) Explain Isotope effect.   [04]

                               OR

Q-4 **(A)** Write a detail note on free electron gas in three dimensions.   [06]

    (B) Explain effect of temperature on Fermi-Dirac distribution.   [04]

Q-5 **(A)** Enlist the junction properties. Explain briefly metal semiconductor junction. [10]

                               OR

Q-5 **(A)** Write a detailed note on Photoelectric effect.   [10]

Q-6 **(A)** With suitable examples define self-assembly process. How it can be used to   [06]
produce nanostructures?

    (B) Write a short note on dip pen nanolithography.   [04]

                               OR

Q-6 **(A)** Explain in detail about self healing structures.   [06]

    (B) Write a short note on molecular synthesis.   [04]

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