

D 31199

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Name.....

Reg. No.....

**THIRD SEMESTER M.Sc. DEGREE (REGULAR/SUPPLEMENTARY)
EXAMINATION, NOVEMBER 2022**

(CBCSS)

Physics

PHY 3C 11—SOLID STATE PHYSICS

(2019 Admission onwards)

Time : Three Hours

Maximum : 30 Weightage

Section A

*8 Short questions, answerable within 7.5 minutes
Answer **all** questions, Each question carries weightage 1.*

1. What is the difference between a metallic bond and a covalent bond ?
2. Explain the concept of Phonons.
3. What is Dulong and Petti's law ? Why does Dulong and Petti's law fails at low temperature ?
4. What are Brillouin Zones ? Construct first Brillouin Zone for a two-dimensional square lattice.
5. What is effective mass of a charge carrier ? What is its importance ?
6. Explain Neel's theory of anti-ferromagnetism
7. Distinguish between hard and soft magnetic materials.
8. What is Meisner effect ?

(8 × 1 = 8 weightage)

Section B

*4 Essay questions, answerable within 30 minutes
Answer any **two** questions, Each question carries weightage 5.*

9. Describe macroscopically the origin of static dielectric constant of a substance and discuss the classical theory of electronic polarization.
10. Obtain the expressions for the carrier concentrations in intrinsic semiconductor.

Turn over

11. What are reciprocal lattices ? Show the reciprocal lattice to BCC lattice is an FCC lattice and reciprocal lattice FCC lattice is BCC lattice.
12. Discuss BCS theory of superconductivity and briefly explain BCS ground state.

(2 × 5 = 10 weightage)

Section C

7 Problem answerable within 15 minutes

*Answer any **four** questions, Each question carries weightage 3.*

13. The distance d_{100} between (100) plane s in BCC structure is 0.32 nm. What is the size of the unit cell ? What is the radius of the atom ?
14. Find the cut off frequency for a one-dimensional monoatomic chain given that the interatomic spacing is 3\AA and velocity of sound 3000 m/s.
15. Find the Fermi velocity of the electrons if the number density of electrons in sodium is $2.52 \times 10^{28} \text{ m}^{-3}$ at room temperature.
16. An electric field of 100 V/m is applied to a n-type semiconductor having hall co-efficient $0.0125 \text{ m}^3/\text{C}$. Determine the current density in the sample if the electron mobility is $0.36 \text{ m}^2 \text{ v}^{-1} \text{ s}^{-1}$.
17. If the magnetization and flux density of a magnetic material be 3200 A/m and 0.005 Wb/m^2 . Calculate the relative permeability of the material.
18. The critical temperature for H_g with isotopic mass 199.5 is 4.18 K. Calculate the critical temperature for an isotopic mass 203.4
19. Copper has an FCC structure and the atomic radius is 0.1278 nm. Calculate the inter planar spacing for (110) and (212) -planes.

(4 × 3 = 12 weightage)