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SVIS 337 A-2K12

B.Sc. VIth Semester Degree Examination

Physics Optional

Statistical Physics, Solid State Physics and Material Science

Paper - 6.1

Time : 3 Hours

Maximum Marks : 80

Instructions to Candidates:

- i) Answer **all** questions from Section - A
- ii) Answer any **five** questions from Section - B
- iii) Answer any **four** questions from Section - C

Section - A

Answer all questions :

(15×1=15)

1. What is boson?
2. Under what conditions Maxwell Boltzmann distribution hold
3. Write any one failure of free electron theory of metals
4. What is Fermi energy at $T = 0$?
5. What is Debye temperature?
6. What is Miller indices?
7. What kind of semiconductor is obtained if silicon is doped with antimony?
8. What is Photo conductivity.
9. Write two uses of thin films
10. State currie Law
11. What is an alloy?
12. What is unit cell?
13. Write one application of super conductivity.
14. What is phase space?
15. Define critical temperature in case of super conductivity.

Section - B

Answer any **five**

(5×5=25)

16. Distinguish between Fermi-Dirac and Bose-Einstein distribution functions.
17. State Dulong and Petit's law and write Einstein's specific heat of solid.
18. Explain working principle of solar cells and write its efficiency equation.
19. What is phase diagram and draw lead - tin (pb - sn) phase diagram.
20. Explain Hall effect and write the equation of Hall co-efficient.
21. Explain Bardeen, Cooper and Schrieffer (BCS) theory of super conductivity.
22. Distinguish between intrinsic and extrinsic Semi-conductors.

Section - C

Answer any **four**

(4×10=40)

23. a) Obtain expression for Fermi energy at $T = 0K$. **(7+3)**
b) Calculate the Fermi energy of a copper for $\left(\frac{N}{L}\right) = 0.440/A^o$ (Considering one electron from each atom).
24. a) Describe Bragg spectrometer experiment for determination of crystal structure.
b) Mono chromatic X - rays are incident on a crystal for which the spacing of the atomic planes is 0.44 nm. The first order maximum in the Bragg reflection occurs when the incident and reflects X - rays make an angle of 39.4° with the crystal planes. What is the wave length of X - rays. **(7+3)**
25. Write methods of preparation of thin films and explain any one method of thin film preparation. **(10)**
26. a) Write the elementary ideas regarding formation of energy bands.
b) Explain electrical conductivity of Semiconductor. **(6+4)**
27. a) Compare paramagnetic, Ferro-magnetic and diamagnetic material based on electron structure.
b) Write few applications of super conductivity. **(7+3)**
28. a) Obtain expression for Maxwell-Boltzmann distribution function.
b) Explain working principle and amplifying action of PNP transistor. **(5+5)**