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Sl. No.

Total No. of Pages : 3

**VI Semester III B.Sc. Examination, September - 2021**

**(Semester Scheme (CBCS))**

**PHYSICS (DSE)**

**Solid State Physics**

**Time : 3 Hours**

**Max. Marks : 80**

**Instruction :** Answer any two each from Part - A, Part - B and Part - C, any three from Part - D and any Ten from Part - E.

**PART - A**

1. Obtain expression for ripple factor and efficiency of a Bridge rectifier. [8]
2. What is biasing of a Transistor? Explain potential divider biasing of a Transistor. [8]
3. Obtain an expression for electron density in an intrinsic semiconductor at thermal equilibrium. [8]

**PART - B**

4. Obtain an expression for specific heat of solids on the basis of Einstein's theory and discuss the results [8]
5. a) Obtain an expression for Hall coefficient in metals. [5]  
b) Deduce the relation between Hall coefficient and mobility. [3]
6. a) Give the construction of AND gate using diodes and explain its working with the truth table. [4]  
b) Write the circuit of a half adder and explain its action. Give the truth table. [4]

**P.T.O.**

**PART - C**

7. a) What is super conductivity? Explain the phenomenon on the basis of BCS theory. [5]  
b) Explain the structure of Nematic liquid crystals. [3]
8. Explain the construction and working of Bragg's x-ray spectrometer. [8]
9. a) Explain the structure of NaCl crystal. [4]  
b) Explain the origin of characteristic x-ray spectra. [4]

**PART - D**

10. The intrinsic carrier density at room temperature in Ge is  $2.37 \times 10^{19} \text{ m}^{-3}$ . If the electron and hole mobilities are  $0.38 \text{ m}^2 \text{ v}^{-1} \text{ s}^{-1}$  and  $0.18 \text{ m}^2 \text{ v}^{-1} \text{ s}^{-1}$  respectively, calculate the resistivity. [4]
11. The energy gap of silicon is 1.1 eV. Find the resistance of Si at  $0^\circ\text{C}$ , if its resistance at  $100^\circ\text{C}$  is  $1000\Omega$ .  
Given :  $k = 1.38 \times 10^{-23} \text{ J K}^{-1}$ . [4]
12. Calculate the Fermi energy of Silver, assuming that the metal has one free electron per atom. Atomic weight of Silver 108, density of silver  $10500 \text{ kg/m}^3$ . [4]
13. Find the number of free electrons per unit volume in copper given relaxation time =  $2.48 \times 10^{-14} \text{ s}$  and electrical conductivity  $5.88 \times 10^7 \Omega^{-1} \text{ m}^{-1}$ . [4]
14. The spacing between principal planes of NaCl crystal is  $2.82 \times 10^{-10} \text{ m}$ . It is found that first order Bragg reflection occurs at an angle of  $10^\circ$ . What is the wavelength of x-rays? [4]

**PART - E**

15. a) Write Barkhausen criterion. [2]  
b) Define bandwidth. [2]  
c) Draw the frequency response curve of a two stage RC coupled amplifier. [2]  
d) Draw the circuit diagram of Hartley oscillator. [2]  
e) Explain Fermi-Dirac distribution function. [2]  
f) Give an example for M-B and B-E statistics. [2]  
g) Mention any two properties of dielectric materials. [2]  
h) What is electric polarization? [2]  
i) State Mosley's Law. [2]  
j) Mention any two applications of liquid crystals. [2]  
k) Explain Meissner effect. [2]  
l) Write any two applications of superconductivity. [2]



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