

MINOR I
PYL 102- PRINCIPLES OF ELECTRONIC MATERIALS
13th February 2016

Answer **all** questions

Time **One Hour**

Maximum Marks **20**

Q.1. State , with justification, whether the following statements are right or wrong: (5)

- (a) The effective number of free electrons in a half filled band is zero.
- (b) The velocity of an electron reaches to a maximum as it reaches a Brillouin zone boundary.
- (c) The area of the first Brillouin zone of a 2D square lattice is double that of the second zone.
- (d) ~~The allowed energy states~~ ^{allowed energy states in} for a given a one dimensional atomic system with periodicity 'a' and potential ' V_0 ' the width of the λ band as well as the width of the forbidden region increases with increasing energy.
- (e) For a given crystalline material only a few electrons get Bragg reflected as they approach a Brillouin zone boundary

Q.2. The electrical conductivity of a metal at room temperature is $5 \times 10^5 \text{ S.cm}^{-1}$. If the velocity of the electrons at Fermi level, $v_F = 10^8 \text{ cm/s}$ and relaxation time, $\tau = 3 \times 10^{-14} \text{ s}$. Calculate the density of electrons which contribute to the conductivity. (5)

Q.3. Find an expression for total number of states in a band (take $T = 0 \text{ K}$). The width of the energy band for silver is 10 eV. How many number of states per unit volume are possible in the band? ($E_F = 5.5 \text{ eV}$, $e\Phi = 4.5 \text{ eV}$). (5)

Q.4. The E versus k relationship for the bottom of the conduction band of a material is of the form $E = A k^2$, where $A = 5.5 \times 10^{-37} \text{ Jm}^2$. Calculate the effective mass of the conduction electrons. (5)

[Constants : $m_e = 9.11 \times 10^{-31} \text{ kg}$, $h = 6.626 \times 10^{-34} \text{ J s}$, $h/2\pi = 1.054 \times 10^{-34} \text{ J s}$, $e V = 1.6 \times 10^{-19} \text{ J}$, $e = 1.6 \times 10^{-19} \text{ coul.}$]

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