Daffodil International University

Department of Electrical and Electronic Engineering

Faculty of Engineering

Mid Term Examination, Spring-2025

Course Code: 0713-215 | Course Title: Electrical Properties of Materials

Section: A, B, C | Level-Term: L2-T1 | Teacher's Initial: SH, AKB

Full Marks: 25 | Exam Date: March 17, 2025 | Time: 1.5 Hours

Answer all the questions

Q1. **Explain** the followings shortly- **CO-1 C(2)** **4**

a) Bravais Lattice.

b) Allotropes.

c) Current Density.

d) Drift Velocity.

Q2. Consider the FCC unit cell of the copper crystal shown in the Fig. 1: **CO-1 C(2)** **6**

a) **Find** the number of atoms per unit cell.

b) **Find** Atomic Packing Factor.

c) **Find** the atomic concentration in Cu and the density of copper crystal given that the radius of Cu is 0.128 nm and atomic mass of copper is $63.5 gmol^{-1}$.

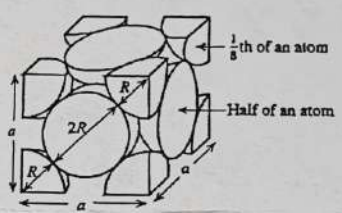

Fig. 1

Q3. A unit cell is shown in the Fig. 2: **CO-1 C(2)** **4**

Cell parameter, a = 0.362 nm

a) **Find** the planner concentration for plane (100).

b) **Find** the planner concentration for plane (111).

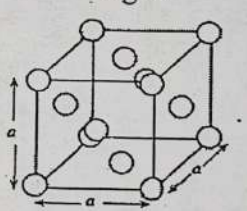

Fig. 2

Q4. For a given crystal in the Fig. 3: **CO-1 C(2)** **3**

Show/ Draw the family of directions: <111>.

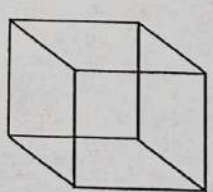

Fig. 3

Q5. a) **Deduce** the expression of the electrical conductivity, $\sigma = en\mu_d$, for a solid using the classical free electron theory (Drude model). **CO-3 C(4)** **5**

b) **Find** the drift mobility and the mean scattering time of conduction electrons in copper at room temperature, given that the conductivity of copper is 5.9×10^5 $\Omega^{-1}cm^{-1}$. The density of copper is 8.96 g cm^{-3} and its atomic mass is 63.5 g mol^{-1}. **CO-3 C(3)** **3**