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Daffodil International University

Department of Electrical and Electronic Engineering

Faculty of Engineering

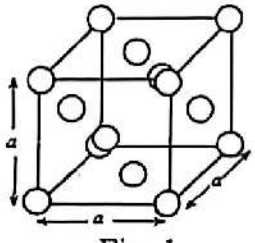
Mid-Term Examination, Fall-2026

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

Section: A, B, C, D | Level-Term: L2-T3 | Teacher's Initial: SH

Full Marks: 25 | Exam Date: October 28, 2026 | Time: 1.5 Hours

[Notes: Answer all the Questions. The second right most column indicates the course outcomes with respective Bloom's level and right most column indicates the allocated marks]

Q1.	Briefly **explain** the generalized molecular bonding theory with neat, clear, and well-labeled diagrams.	**CO-1 (C2)**	4
Q2.	A unit cell is shown in the Fig. 1: Cell parameter, a = 0.362 nm a) **Find** the planner concentration for plane (110). b) **Find** the planner concentration for plane (111).  Fig. 1	**CO-1 (C2)**	4
Q3.	The energy of vacancy formation in the Ge crystal is about 2.2 eV. **Calculate** the fractional concentration of vacancies in Ge at 938 °C, just below its melting temperature. **Estimate** the vacancy concentration given that the atomic mass and density of Ge are 72.64 g mol^{-1} and 5.32 g cm^{-3}, respectively. Neglect the change in the density with temperature.	**CO-1 (C2)**	4
Q4.	a) **Deduce** the expression of the electrical conductivity, $\sigma = en\mu_d$, for a solid using the classical free electron theory.	**CO-3 (C4)**	5
	b) **Calculate** 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}. If the applied electric field is 5 Vcm^{-1}, **estimate** the mean free path of conduction electrons between collisions.	**CO-3 (C3)**	4
Q5.	Using Fourier's Law of thermal conduction and Ohm's law of resistivity, **derive** the model for thermal resistivity when heat flows through a solid crystal.	**CO-3 (C4)**	4