



# Daffodil International University

Faculty of Science & Information Technology

Department of Computer Science & Engineering

Midterm Examination, Fall 2025

Course Code: PHY102, Course Title: Physics II

Level: 1 Term: 3 Batch: 68

Time: 01:30 Hrs

Marks: 25

Answer ALL Questions

[The figures in the right margin indicate the full marks and corresponding course outcomes. All portions of each question must be answered sequentially.]

|    |    |                                                                                                                                                                                                                                                                                                                                                                          |     |     |
|----|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|
| 1. | a) | Identify the limitations of Coulomb's Law.                                                                                                                                                                                                                                                                                                                               | 1   | CO1 |
|    | b) | State Ampère's Law.                                                                                                                                                                                                                                                                                                                                                      | 1   |     |
|    | c) | Relate drift velocity with current density.                                                                                                                                                                                                                                                                                                                              | 1   |     |
|    | d) | Recall the concept "Lorentz Force".                                                                                                                                                                                                                                                                                                                                      | 1   |     |
|    | e) | Distinguish between resistivity and conductivity.                                                                                                                                                                                                                                                                                                                        | 1   |     |
| 2. | a) | A father teaches his daughter how to protect sensitive equipment from high current by using a low resistance in parallel. <b>Explain</b> how this protects the equipment and <b>determine</b> the current flowing through the low resistance.                                                                                                                            | 3   | CO2 |
|    | b) | An engineer is designing a touch sensor using two flat metal plates placed parallel to each other with a thin insulating layer in between. <b>Demonstrate</b> the capacitance of this type of capacitors.                                                                                                                                                                | 3   |     |
|    | c) | During an electronics workshop, a technician notices that a compass needle deflects near a long, straight current-carrying wire. Using the Biot-Savart law, <b>derive</b> the expression for the magnetic field at a distance $r$ from the wire carrying a steady current $I$ .                                                                                          | 4   |     |
| 3. | a) | A copper wire of cross-sectional area $1 \text{ mm}^2$ carries a current of 10 A. If the number of free electrons per cubic meter is $1 \times 10^{28}$ , determine<br>a) the drift velocity of the electrons, and<br>b) the current density.                                                                                                                            | 2.5 | CO3 |
|    | b) | A large, non-conducting sheet carries a uniform surface charge density of $\sigma = 3 \times 10^{-6} \text{ C/m}^2$ .<br>a) Calculate the electric field intensity near the surface of the sheet.<br>b) If a test charge of $q = 2 \times 10^{-9} \text{ C}$ is placed at some distance from the sheet, determine the magnitude of the electrostatic force acting on it. | 2.5 |     |
|    | c) | The magnetic flux through a flat surface of area $40 \text{ cm}^2$ in a uniform magnetic field of 1.2 T is $2.4 \times 10^{-3} \text{ Wb}$ . What is the angle (in radians) between the plane and the magnetic field?                                                                                                                                                    | 2.5 |     |
|    | d) | The primary coil of a transformer has 200 turns and is connected to a 120 V supply. If the secondary coil has 800 turns, determine the secondary voltage.                                                                                                                                                                                                                | 2.5 |     |