Daffodil International University

Faculty of Science & Information Technology

Department of Computer Science and Engineering

Midterm Examination, Spring-2026

Course Code: PHY102, Course Title: Physics-II

Level: 01 Term: 03 Batch: 69

Time: 1 Hour and 30 Minutes **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)	State Coulomb's law and relate it for a dielectric medium.	2	CO-1
	(b)	List the differences between self-inductance and mutual inductance?	2	
	(c)	Describe how drift velocity changes when charge carrier density decreases.	1	
2.	(a)	In an underground cable fault-detection setup using a Wheatstone bridge, an unknown resistance X is compared with known resistances P, Q, and R. A galvanometer is connected across the bridge. Using Kirchhoff's laws, derive the condition for balance of the Wheatstone bridge.	4	CO-2
	(b)	In modeling charged transmission wires, an infinite uniformly charged rod is often assumed. Using Gauss's law, determine the electric field and electric flux near the rod.	3	
	(c)	Circular current-carrying loops are used in devices such as galvanometers and magnetic sensors. If the wire has 35 identical loops, applying the Biot-Savart law, compute the magnetic field at the center of the loops.	3	
3.	(a)	Two point charges, $q_1 = +3\ \mu C$ and $q_2 = -2\ \mu C$, are separated by 0.12 m. Find the point along the line joining them where the electric field is zero.	2.5	CO-3
	(b)	A rectangular frame of dimensions $0.2\ m \times 0.3\ m$ is placed in a uniform magnetic field of magnitude $B = 0.5\ T$. The plane of the frame makes an angle $\theta = 30°$ with the direction of the magnetic field. Calculate the magnetic flux through the frame.	2.5	
	(c)	A spherical capacitor has two concentric conducting shells of radii $R_1 = 5$ cm and $R_2 = 10$ cm. The space between the shells is filled with a dielectric of permittivity $\varepsilon_0 = 8.85 \times 10^{-12}\ F/m$. Calculate the capacitance of the spherical capacitor.	2.5	
	(d)	A step-up transformer has a turn ratio of 1:10. The primary voltage is 120 V and the load on the secondary draws 2 A. Calculate the secondary voltage.	2.5	

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