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Daffodil International University

Department of Electrical and Electronic Engineering
Faculty of Engineering
Mid-Term Examination, Fall–2025

Course Code: 0533-111 | Course Title: Physics
Section: A,B,C,D,E,F,G,H | Level-Term: L1-T1 | Teacher's Initial: SAT, MMR
Full Marks: 25 | Exam Date: 18 October 2025 | Time: 1.5 Hours

Note: There are three sets of questions in total. Answer all of them. Right hand margin indicates full marks.

Q1. (a) **Explain** how Young's double slit experiment demonstrates the concept of wave-particle duality. **CO-1 (C2)** **[2]**

(b) **Distinguish** between isothermal process and adiabatic process. **CO-1 (C2)** **[2]**

Q2. (a) **Derive** the relation $C_p = C_v + R$ for an ideal gas, where C_p and C_v are the molar specific heats at constant pressure and constant volume, respectively, and R is the universal gas constant. **CO-2 (C3)** **[4]**

(b) **Show** that, in Young's double-slit experiment, the distance between two consecutive bright fringes is equal to the distance between two consecutive dark fringes. **CO-2 (C3)** **[4]**

Q3. (a) A Carnot engine has 60% efficiency when the source temperature is 50°C. **Calculate** the decrease in temperature of the heat sink to make its efficiency 75%. **CO-2 (C3)** **[3]**

(b) A plano-convex lens of radius of curvature R = 1.0 m is placed on a flat glass plate, and illuminated with monochromatic light of wavelength $\lambda = 600$ nm. Find the radius of the 5th dark ring observed in reflected light. If the diameter of the 10th bright ring is measured as 5.22 mm, **calculate** the wavelength of the light used. **CO-2 (C3)** **[3]**

(c) A monoatomic ideal gas ($\gamma = \frac{5}{3}$) undergoes a reversible adiabatic expansion. Initially, the gas has a pressure $P_1 = 1.00$ atm and a volume $V_1 = 10.0$ L. It expands to a final volume $V_2 = 20.0$ L. **Calculate** the final pressure P_2 and the work done by the gas (in joules). **CO-2 (C3)** **[4]**

(d) In a Young's double-slit experiment, two slits are separated by a distance of 0.5 mm. The screen is placed 1.5 m away from the slits. If monochromatic light of wavelength 600 nm is used and the screen is 0.1 m tall. **Calculate** how many dark fringes will appear within this screen height? **CO-2 (C3)** **[3]**