Daffodil International University

Faculty of Science & Information Technology

Department of Computer Science and Engineering

Final Examination, Spring-2026

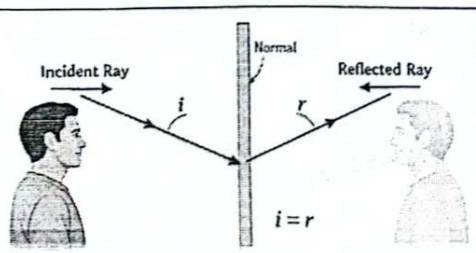
Course Code: PHY101, Course Title: Physics I

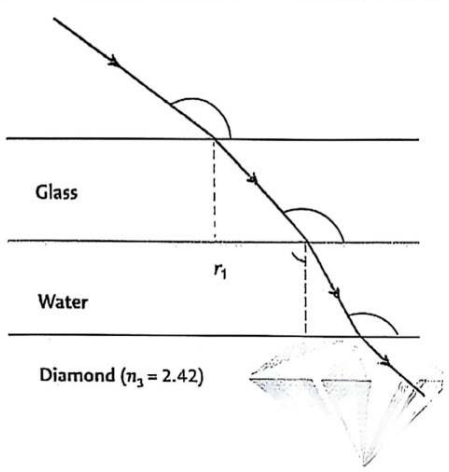
Level: 1 Term: 2 Batch: 70

Time: 2 Hour **Marks: 40**

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 the two conditions for total internal reflection and briefly explain why it occurs only from a denser to a rarer medium.	2	CO1
	b)	Draw the P–V diagram of the Carnot cycle and clearly identify each process involved in the cycle.	2	
	c)	Write down difference between Fresnel and Fraunhofer diffraction.	2	
	d)	Identify the fundamental assumption of kinetic theory of gases.	2	
	e)	Why is an air film used in Newton's rings experiment? Explain it.	2	
2.	*a)*	A fixed amount of ideal gas is enclosed in a well-insulated piston–cylinder system. The gas undergoes a rapid adiabatic compression from an initial state (P_1, V_1, T_1) to a final state (P_2, V_2, T_2). During this process, no heat is exchanged with the surroundings. (i) Using the adiabatic condition, show that pressure and volume follow the relation $PV^{\gamma} = \text{constant}$. ii) Hence, by combining this relation with the ideal gas equation, derive the temperature–volume relation $TV^{\gamma-1} = \text{constant}$.	3+1	CO2
	b)	In a Young's Double Slit Experiment, monochromatic light passes through two closely spaced slits and forms an interference pattern on a distant screen. A student observes alternating bright and dark fringes due to the superposition of light waves from the two slits. i) By considering the waves arriving at a point on the screen, derive the relation between phase difference and path difference. ii) Hence, show that the conditions for constructive and destructive interference lead to equal fringe widths for both bright and dark fringes.	3+1	
	c)	State Brewster's law and derive its mathematical expression using the phenomenon of polarization. Also, explain the behavior of light associated with this phenomenon.	3+1	
	d)	A person stands in front of a plane mirror and observes their image formed behind it, as shown in the diagram. State Fermat's principle and, using the fact that light takes the least time to travel, derive the law of reflection from the given diagram. 	3	

3.	*a)*	Newton's rings are formed by reflection in the air film between a plane surface and a spherical surface. If the diameters of the 3rd and 23rd bright rings are 0.181 cm and 0.501 cm respectively, what is the radius of curvature of the spherical surface? Convert the units into mm. The wavelength of light used is 5456 A.U.	3	CO3
	b)	Find the change in entropy in converting 5kg ice at 0°C to steam at 100°C. The specific latent heat of fusion of ice is 3.36×10^5 Jkg^{-1} and Latent heat of vaporization, 2.26×10^6 Jkg^{-1}.	3	
	c)	Given that a kg-mole of hydrogen occupies a volume of 22.4 m^3 at N.T.P. Calculate the root mean square velocity of the molecules at N.T.P.	3	
	d)	A heat engine operates between two reservoirs where the sink temperature is 15°C and efficiency is 45%. Find the required source temperature for the efficiency to increase to 75%.	3	
	e)	A light ray travels from glass (n = 1.5) into water (n = 1.33) and then into diamond (n = 2.42). The angle of incidence in glass is 45°. Calculate i) Angle of refraction in water ii) Angle of refraction in diamond (after second boundary) iii) Check whether total internal reflection is possible at any boundary 	3	