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Daffodil International University

Faculty of Science & Information Technology

Department of Software Engineering

Mid Term Examination, Fall 2026

Course Code: PHY 101; Course Title: Physics-I

Sections & Teachers: SH(A-D), KI(E-F), RH(G-J) & BB(K-N)

Time: 1 Hour 30 Mins **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. In a computer lab, a technician pushes a heavy server rack across the floor. **Draw** and **describe** a graph that represents the relationship between applied force and friction. [2.5] CO-*1*, *C1*

   b. In a robotics project, students observe waves travelling through air and along a stretched string. **Identify** and **describe** the basic differences between longitudinal and transverse waves with suitable examples and figures. [2.5]

2. a. During a vibration test of a cable in a student project, two identical progressive waves of amplitude A, angular frequency ω and wavelength λ travel in opposite directions along the same cable. **Estimate** the equation of the resulting standing wave and **compute** the conditions for the positions of nodes and antinodes. [5] CO-*2*, *C2*

   b. A group of SWE students is preparing a projectile-motion simulation for a game. **Approximate** the expressions for different parameters (trajectory, range, maximum height) involved in projectile motion. **Predict** the launch angle for which the maximum height of a projectile is equal to its horizontal range. [5]

3. a. In a game physics simulation, a ball is thrown from the ground with a speed of 30 m/s at an angle of 45° above the horizontal. Take $g = 9.8$ m/s² and neglect air resistance. **Calculate**: [5] CO-*3*, *C3*
   - **(i)** The time at which the ball reach 10 m, once going up and once coming down?
   - **(ii)** The speed of the ball at each of the two points?
   - **(iii)** The direction of the velocity at each point, measured from the horizontal?
   - **(iv)** The horizontal distance between the two points?

   b. During a robotics lab test, a block of mass $m = 200$ g moving with a speed $v = 20$ m/s collides inelastically with a block of mass $M = 500$ g, initially at rest, that is attached to a spring of spring constant $k = 280$ N/m. The other end of the spring is fixed to a wall. Ignore friction. **Calculate**: [5]
   - **(i)** The speed of the system of the two blocks after the collision
   - **(ii)** The amplitude of oscillation of the two blocks.
   - **(iii)** The time period and the total energy of the oscillating system.