University of Asia Pacific
Department of Basic Sciences and Humanities
Final Examination, Fall -2012
Program: B.Sc Engineering (Civil)

Course Title: Physics I   Course Code: PHY-101   Credit: 3.00
Time: 3.00 Hours   Full Marks: 150

*[N.B- The figures in the right margin indicate full marks. There are two sections in the question paper namely "**SECTION A**" and "**SECTION B**". Answer from both sections according to the instruction mentioned in each section.]*

SECTION A
There are **FOUR** questions. Answer any **THREE**

Marks

1. (a) Show that the total energy of the simple harmonic oscillator is $E = \frac{1}{2}kA^2$, where the symbols have their usual meanings.   **15**

    (b) A particle executes simple harmonic motion given by the equation $y = 12\sin\left(\frac{2\pi t}{10} + \frac{\pi}{4}\right)$ Calculate (i) amplitude, (ii) frequency, (iii) epoch, (iv) acceleration at $t = 5\ s$.   **10**

2. (a) Show that the differential equation of a progressive wave is $\frac{d^2 y}{dt^2} = v^2 \frac{d^2 y}{dx^2}$, where the symbols have their usual meanings.   **15**

    (b) Show that for a particle executing simple harmonic motion, the acceleration at any instant is $a = -\omega^2 y$, where the symbols have their usual meanings.   **10**

3. (a) Prove that the equation of Newton's formula for velocity of sound in gas is $V = \sqrt{\frac{P}{\rho}}$, where the symbols have their usual meanings.   **15**

    (b) Discuss the effect of temperature on the velocity of sound in gas.   **10**

4. (a) Derive the equation of Doppler effect when observer at rest and source in motion.   **15**

    (b) Two trains traveling in the opposite direction at *100 km/hr* each, cross each other while one of them is whistling. If the frequency of the note is *800 Hz*, find the apparent pitch as heard by an observer in the other train: **10**
        (i) before the trains cross each other
        (ii) after the trains have crossed each other
    Consider the velocity of sound at NTP.

[Turn over

SECTION B
There are **FOUR** questions. Answer any **THREE**

Marks

5. (a) Derive the necessary conditions under which elliptically and circularly polarized light are formed by deriving the general equation of ellipse, $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} - \dfrac{2xy}{ab}\cos\delta = \sin^2\delta$.

15

(b) Show that at Brewster's angle the reflected and refracted rays are at right angles to each other.

10

6. (a) Prove the law of Malus, $I \propto \cos^2\theta$, where the symbols have their usual meanings.

15

(b) Write short notes on half and quarter waveplate.

10

7. (a) Show that the moment of inertia of a ring is $I = MR^2$, where the symbols have their usual meanings.

15

(b) Prove that the kinetic energy of a rotating body is $= \dfrac{1}{2}I\omega^2$, where the symbols have their usual meanings.

10

8. (a) Show that the moment of inertia of a uniform rod is $\dfrac{1}{12}ML^2$, where the symbols have their usual meanings.

15

(b) Derive the following relations: angular momentum $L = I\omega$ and torque $\tau = I\alpha$, where the symbols have their usual meanings.

10