Uva Wellassa University of Sri Lanka
Faculty of Science and Technology
Department of Science and Technology
100 Level 1st Semester Examination – June/July 2017
SCT 151-2 Mechanics, Waves and Vibrations

Uva Wellassa University

Part II

Instructions to candidates:
Duration: 2 Hours.
Number of questions: Part I - 40 MCQs
Part II - 2 Essay Questions
Answer all questions.
Mark allocation: Part I - 80 marks and Part II - 40 marks.
Note: Handover the question paper along with the answer sheet.

1. Consider a car having a motion with an initial velocity u and final velocity v with a constant acceleration a in a time period t.
   a. Draw a velocity vs time graph for the motion of the car.

   (3 marks)

   b. Using the above graph show that the displacement(S) travelled by the car can be expressed as, $S = ut + \frac{1}{2}at^2$.

   (5 marks)

   c. A pendulum with a mass m hangs from the roof of a car travelling on a level road. The pendulum string makes an angle of θ with the vertical as shown in figure 01.
   Draw the free body diagram and show that the acceleration(a) of the car can be given by $g\tan(\theta)$. (Hint: The acceleration of the car is the same as that of the pendulum)

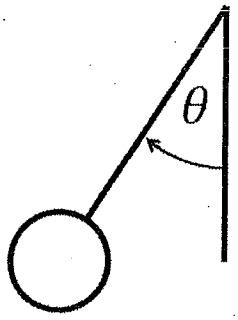

Figure 01

   (5 marks)

   d. When car is accelerating about 5 $seconds$ along a straight line the string of the pendulum makes an angle 30^0 to the vertical. Assuming the car was initially at rest,

      i. Calculate the distance travelled by the car.

(4 marks)

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ii. If the car weights $10\ 000\ N$, calculate the kinetic energy gained by the car.

(3 marks)

2. Let a transverse wave traveling along a stretched string be,

$$y_1(x,t) = 5\sin(3x + 6t)$$

Where all the constants are in SI units. $(5\ m, 3\ rad\ m^{-1}, 6\ rad\ s^{-1})$

a. Briefly explain what is meant by a transverse wave.

(2 marks)

b. Identify the angular wave number(k) and angular frequency(ω) of the wave.

(2 marks)

c. Show that the particle at $5\ m$ is undergoing a SHM described by the equation $y(t) = 5\sin(6t + 15)$.

(3 marks)

d. What will be the displacement of that particle after $5\ s$?

(2 marks)

e. If the wave described by the equation $y_2(x,t) = 5\ sin(3x + 6t + \emptyset)$ also travelling in the same string along the same direction,

Use the principle of superposition to show that the equation of the resultant wave after the interference of the waves will be $y_{net}(x,\ t) = \left[10\cos\left(\frac{\emptyset}{2}\right)\right]\sin\left(3x + 6t + \frac{\emptyset}{2}\right)$. [You may use the equations $\sin\alpha + \sin\beta = 2\sin\left(\frac{\alpha+\beta}{2}\right)\cos\left(\frac{\alpha-\beta}{2}\right)$ and $\cos(-\gamma) = \cos(\gamma)$.]

(4 marks)

f. Identify the amplitude of the resultant wave.

(2 marks)

g. What will be the amplitude of the resultant wave when $\emptyset = 0$?

(2 marks)

h. If $\emptyset = \pi$, show that there will not be a resultant wave after the interference.

(3 marks)