Name :	**Roll Number :**

PHY102: Quiz : 2

IISER, Pune. (25 March, 2019.)

Time: 50 minutes. *Marks : 30*

Answer all the questions.
For questions 1 and 2 only a sketch is required; Do not derive anything.
No marks for sketches drawn without axis lables.
Unless specified otherwise, all the symbols have their usual meanings.
Use the same symbol and notation as given in the questions.
Show all the steps of your calculations. No marks for missing steps.

1. A trianglular pulse shown in the figure 1 is travelling in a region with impedance Z_1. It is reflected at the fixed end of the string where $Z_2 = \infty$. Sketch the shape of the pulse after length $L/2$ and length L have been reflected. (4)

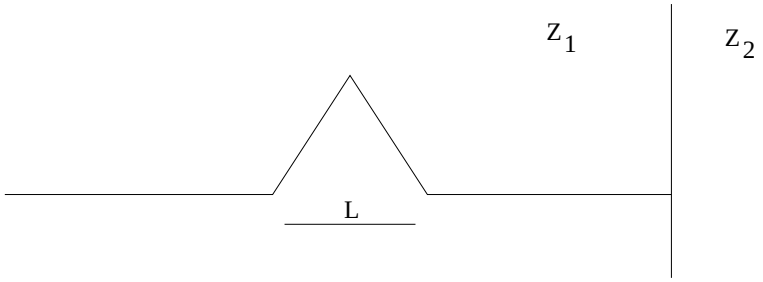

Figure 1:

2. A string is tied between two support separated by distance L. It has uniform tension T. Sketch the 2nd, 3rd and 4th normal mode of oscillation for this system. (6)

3. The phase velocity v of transverse waves in a crystal of atomic separation a is given by,

$$v = c\left(\frac{\sin(ka/2)}{ka/2}\right)$$

where k is the wave number and c is a constant. Find the group velocity. (5)

4. A uniform string of length 2.5 m and mass 0.01 kg is placed under a tension of 10 N.
(a) What is the frequency of its fundamental mode.
(b) If the string is plucked transversely and is then touched at a point 0.5 m from one end, what frequencies are allowed by the system ? (2+3)

5. A progressive wave of the form $y_i(x,t) = 2.0\ \cos(2\pi x - 50\pi t)$ moves through a string towards the boundary with a second string. The boundary between the two strings is located at $x = 0$. The speed of the wave on the second string is 50 m/sec. Obtain an expression for reflected wave $y_r(x,t)$

and transmitted wave $y_t(x,t)$. (5)

6. Let $u(x,t) = A\sin(\omega_1 t + k_1 x)$ and $v(x,t) = B\sin(\omega_2 t + k_2 x)$ be two waves propagating in the same medium with same speed c. Let x_1 and x_2 represent two positions at which the particle displacements differ in phase by $\Delta\phi$. This phase difference is $\Delta\phi_u$ and $\Delta\phi_v$ respectively for the two waves $u(x,t)$ and $v(x,t)$. Then, show that the ratio of their maximum particle velocities is

$$\frac{\dot{u}_{max}}{\dot{v}_{max}} = \frac{A\ \Delta\phi_u}{B\ \Delta\phi_v}$$

(5)