

EASTERN UNIVERSITY, SRI LANKA

SECOND EXAMINATION IN SCIENCE - 2004/2005 (2006)

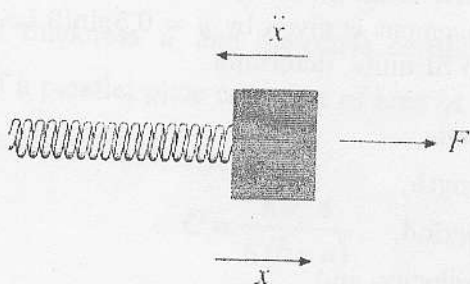
PH 206

Waves and Vibration

Answer ALL questions.

Time: 1 hour

- (Q1) Explain the meaning of 'Free vibration' and 'Forced vibration' in physics. An object of mass m is placed in frictionless plane and connected to one end of the spring having spring constant k . The other end of the spring is fixed firmly to a wall as shown in the figure.



If the system is displaced through a distance x by a force F , then show that the motion of the object is a simple harmonic motion. Hence by defining the appropriate symbols show that the displacement of the object at any time t is given by $x = A \sin(\omega t + \phi)$.

In the above case

- Show that the maximum kinetic energy of the object is $\frac{1}{2}kA^2$
- Sketch the variations of the potential energy and the kinetic energy of the object against the displacement in the same graph and explain its physical significance.
- Show that at a displacement $\frac{A}{\sqrt{2}}$, the object will have the same potential energy and kinetic energy.

(Q2) Explain the meaning of wavelength, frequency and amplitude as applied to waves. Write down the difference between transverse and longitudinal waves.

Explain why the displacement $A \sin(kx - \omega t)$ at position x and time t is called a plane wave. In which direction does it travel? Here the symbols have their usual meaning.

If a wave displacement is given by $y = 0.5 \sin(0.1x - 0.4t)$, where all quantities are in SI units, determine

- (a) the amplitude,
- (b) the wavelength,
- (c) the time period,
- (d) the wave velocity, and
- (e) the acceleration a of the displacement.

Sketch graph of y and a at $t = 0$ for x in the range 0 to 100 m.