Numerical examples- module 1-Oscillations

1) A man weighing 600N steps on a spring scale machine. The spring in the machine is compressed by 1 cm. Find the force constant of the spring.

Ans: $k = 6 \times 10^4 N/m$

2) A mass of 5kg is suspended from the free end of a spring. When set for vertical oscillations, the system executes 100 oscillations in 40 sec. Calculate the force constant of the spring.

Ans: $k = 1233.7\ N/m$

6) A free particle is executing simple harmonic motion in a straight line. The maximum velocity it attains during any oscillations is 62.8 m/s. Find the frequency of the oscillations its amplitude is 0.5m.

Ans: f=20Hz

7) A spring undergoes an extension of 5 cm for a load of 50g. Find its frequency of oscillations, if it is set for vertical oscillations with a load of 200g attached to its bottom.

Ans f=1.11 Hz

8)Calculate the resonance frequency of a spring of force constant 1974 N/m carrying a mass of 2kg.

Ans f=5 Hz

9) Calculate the resonance for a simple pendulum of length 1m.

Ans: f=0.5 Hz

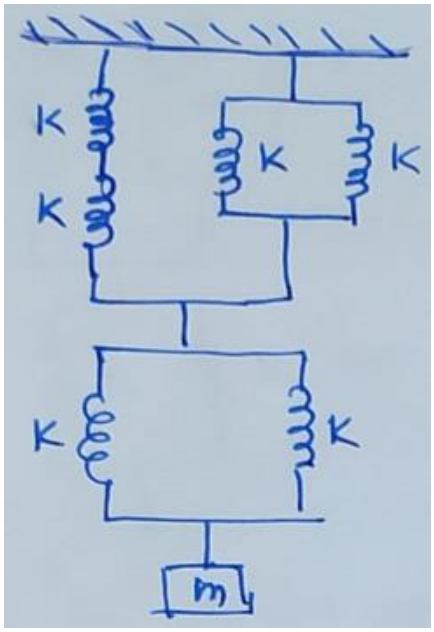
10) Given the force constant as 9.8 N/m for a spring, estimate the number of oscillations it would complete in 1 minute if it is set for oscillations with a load of 89.37g.

Ans: Oscillations per minute = 100

11)A mass of 10kg is suspended from free end of spring when set for oscillations, the systems executes 100 oscillations in 5 mins. Calculate the force constant.

Ans: k=2.27 N/m

12) An arrangement of identical springs is shown in the figure. If the spring constant of each spring is 100N/m. calculate the effective spring constant of the combination. Also calculate the frequency of oscillations of the systems when a mass of 1kg is attached.



Ans f= 1.67 Hz

13) Find the frequency of vibration of a sonometer wire reaches a maximum velocity of 6.28m/s, when its amplitude of vibration is 1cm. (assume free vibrations)

f=100Hz

14) A mass of 100kg is mounted on 4 springs each of which has spring constant $4 \times 10^3 N/m$. The motor moves only in vertical direction. Find the natural frequency of this system.

f= 2Hz

15) In the two mass spring systems shown in the figures, k1, =2000 N/m, k2 = 1500 N/m, k3=3000 N/m and k4 = k5 = 500 N/m. Find the 'm' such that the systems have a natural frequency of 10Hz in each of the cases.

Ans: m1=0.1kg, m2= 0.422kg

16)Find the frequency of oscillations of a free particle executing SHM of amplitude 0.35m, if the maximum velocity it can attain is 220m/s.

F=100Hz

17) In simple harmonic motion, displacement is described by the equation x(t) = A sin(6t+0.2). What is the time period of oscillation?

Ans T=1 sec or T=π/3 sec