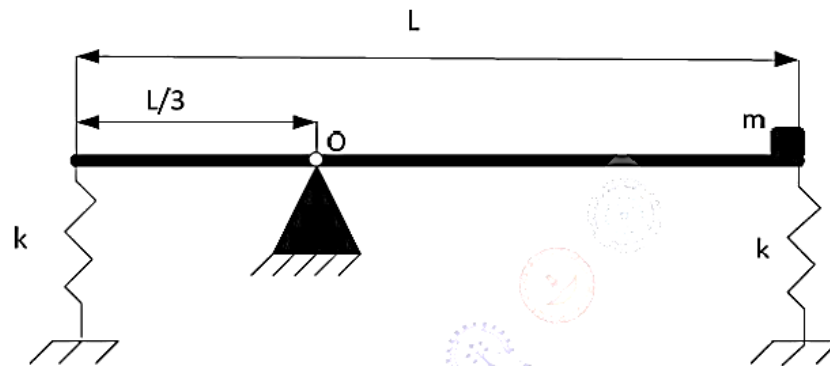


FREE UNDAMPED VIBRATION

(1)

A thin uniform rigid bar of length L and mass M is hinged at point O , located at a distance of $\frac{L}{3}$ from one of its ends. The bar is further supported using springs, each of stiffness k , located at the two ends. A particle of mass $m = \frac{M}{4}$ is fixed at one end of the bar, as shown in the figure. For small rotations of the bar about O , the natural frequency of the system is



(A) $\sqrt{\frac{5k}{M}}$

(B) $\sqrt{\frac{5k}{2M}}$

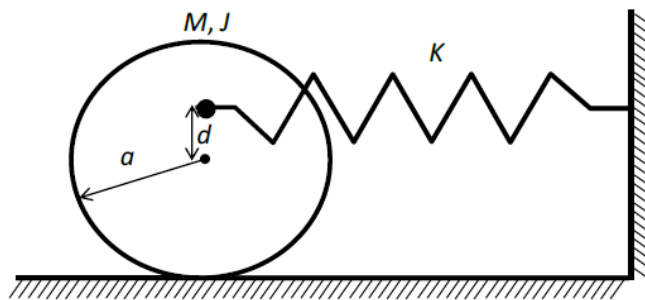
(C) $\sqrt{\frac{3k}{2M}}$

(D) $\sqrt{\frac{3k}{M}}$

[ME GATE 2017]

(2)

A solid disc with radius a is connected to a spring at a point d above the center of the disc. The other end of the spring is fixed to the vertical wall. The disc is free to roll without slipping on the ground. The mass of the disc is M and the spring constant is K . The polar moment of inertia for the disc about its centre is $J = Ma^2/2$.



The natural frequency of this system in rad/s is given by

(A) $\sqrt{\frac{2K(a+d)^2}{3Ma^2}}$

(B) $\sqrt{\frac{2K}{3M}}$

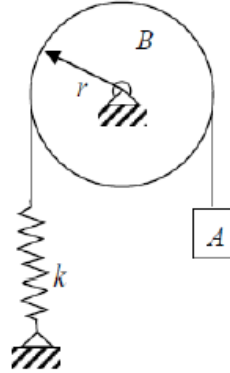
(C) $\sqrt{\frac{2K(a+d)^2}{Ma^2}}$

(D) $\sqrt{\frac{K(a+d)^2}{Ma^2}}$

[ME GATE 2016]

(3)

The system shown in the figure consists of block A of mass 5 kg connected to a spring through a massless rope passing over pulley B of radius r and mass 20 kg. The spring constant k is 1500 N/m. If there is no slipping of the rope over the pulley, the natural frequency of the system is _____ rad/s.



[ME GATE 2016]

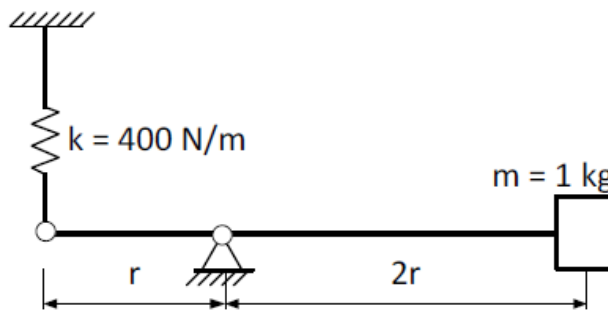
(4)

The static deflection of a spring under gravity, when a mass of 1 kg is suspended from it, is 1 mm. Assume the acceleration due to gravity $g = 10 \text{ m/s}^2$. The natural frequency of this spring-mass system (in rad/s) is _____

[ME GATE 2016]

(5)

Considering massless rigid rod and small oscillations, the natural frequency (in rad/s) of vibration of the system shown in the figure is



(A) $\sqrt{\frac{400}{1}}$

(B) $\sqrt{\frac{400}{2}}$

(C) $\sqrt{\frac{400}{3}}$

(D) $\sqrt{\frac{400}{4}}$

[ME GATE 2015]