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NPTEL

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Courses » Engineering Mechanics Announcements **Course** Ask a Question Progress Mentor

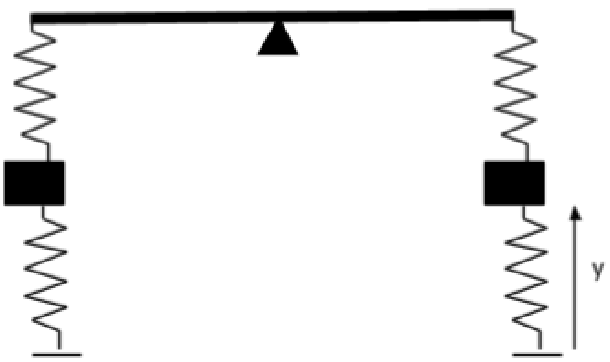
Unit 12 - Week 11 Lectures

Assignment 11

The due date for submitting this assignment has passed. **Due on 2016-10-05, 23:59 IST.**

Submitted assignment

1) Consider the problem in the solved examples in week 11. Here a rod of length *L* is fixed with two masses of masses *M* each and four equivalent springs of spring constant *k* as given in the figure. The rod can rotate about its mid-point which is on a support; the sense of positive angle θ is shown in the figure. The distance of each mass *y* is measured from the ground with positive direction as shown. The equation of motion for the mass on the right is given as ***1 point***



- $M\ddot{y} = -2ky - k\frac{L}{2}\theta$
- $M\ddot{y} = 2k(y - \frac{L}{2}\theta)$
- $M\ddot{y} = -2ky + k\frac{L}{2}\theta$
- $M\ddot{y} = 2ky + k\frac{L}{2}\theta$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$M\ddot{y} = -2ky + k\frac{L}{2}\theta$

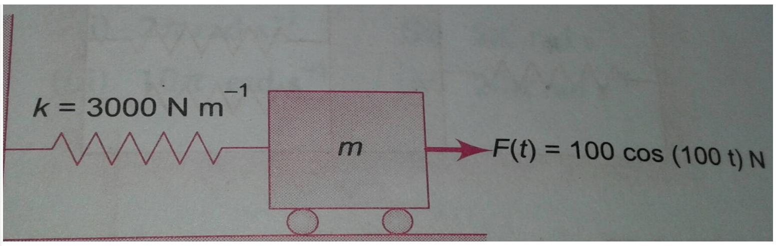
2) A mass m attached to a spring is subjected to a harmonic force as shown in the figure below. The amplitude of the forced motion is observed to be 50 mm. The value of m (in kg) is ***1 point***

harmonic oscillator II

- Simple harmonic oscillator XV: Energy and power in a forced damped harmonic oscillator
- Simple harmonic oscillator XVI: Solved examples
- Equation of motion in a uniformly accelerating frame
- Motion described in a uniformly accelerating frame; solved examples -I
- Motion described in a uniformly accelerating frame; solved examples -II
- Quiz : Assignment 11

Week 12 Lectures

Review Problems



- 0.1
- 1.0
- 0.5
- 0.3

No, the answer is incorrect.
Score: 0

Accepted Answers:
0.5

3) A damped oscillator is described by the equation $2\ddot{x} + \dot{x} + 16x = 0$. It is subjected to a force $F(t) = 3\sin 2t$ in SI units. Amplitude of the steady state motion of the oscillator is close to ***1 point***

- 1.5 m
- 0.73 m
- 0.36 m
- 0.18 m

No, the answer is incorrect.
Score: 0

Accepted Answers:
0.73 m

4) For the same oscillator given in the previous question. The displacement of the oscillator ***1 point***

- lags behind the applied force by about 15°.
- leads the applied force by about 15°.
- lags behind the applied force by about 75°.
- lags behind the applied force by about 75°.

No, the answer is incorrect.
Score: 0

Accepted Answers:
lags behind the applied force by about 15°.

5) For the same oscillator as given above. The average power required to maintain the steady-state motion is (in J per cycle) ***1 point***

- $\frac{9}{17}$
- $\frac{9}{34}$
- $\frac{3}{17}$
- $\frac{3}{34}$

No, the answer is incorrect.
Score: 0

Accepted Answers:

$\frac{9}{17}$

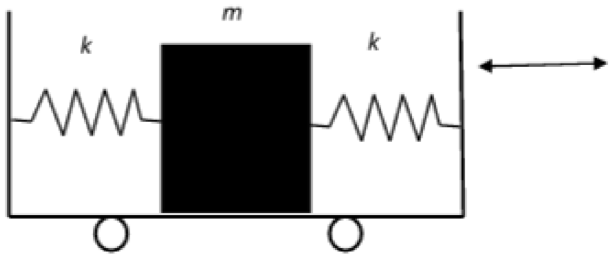
6) The quality factor of the same oscillator is **1 point**

- 16
- 2
- $4\sqrt{2}$
- $2\sqrt{2}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$4\sqrt{2}$

7) Consider a block of mass *m* inside a box and attached to it are two identical springs of spring constant *k* which are connected to the opposite walls of the box. There is no friction between the block and the box. If the box is now made to oscillate as $\$x_box = bsin\omega t\$$, the range of frequencies for which the amplitude of the oscillations of the block in steady state is less than 2b is (considering damping to be negligible except that it is sufficient to damp out natural frequency oscillations of the block) **1 point**



- $\omega < \sqrt{\frac{3k}{2m}} \quad and \quad \omega > \sqrt{\frac{3k}{m}}$
- $\omega < \sqrt{\frac{k}{2m}}$
- $\omega < \sqrt{\frac{k}{m}} \quad and \quad \omega > \sqrt{\frac{3k}{m}}$
- $\omega < \sqrt{\frac{k}{2m}} \quad and \quad \omega > \sqrt{\frac{5k}{2m}}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\omega < \sqrt{\frac{k}{m}} \quad and \quad \omega > \sqrt{\frac{3k}{m}}$

8) A person is sitting in a car. At *t*=0, the car starts accelerating with acceleration *a* on a straight line road. At the same time a ball is thrown vertically down with speed v_0 from the top of a nearby building. The trajectory seen by a person in the car will be **1 point**

- vertical straight line
- parabolic
- elliptical
- straight line at an angle from the vertical

No, the answer is incorrect.
Score: 0

Accepted Answers:
parabolic

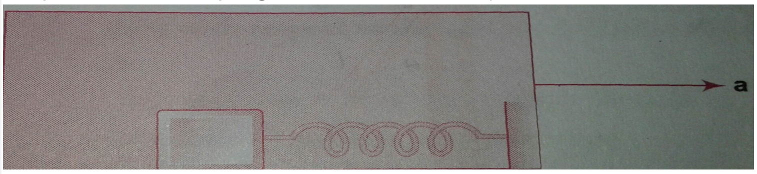
9) A helium balloon is held by a thread in a car moving with uniform speed on a straight road so that it is floating inside. When the car accelerates, then with respect to the car, the balloon will tend to **1 point**

- Stay where it is
- move forward
- move backward
- move up

No, the answer is incorrect.
Score: 0

Accepted Answers:
move forward

10)A spring-mass system with a spring of unstreched length l, spring constant k, and mass m is fixed inside a box, as shown in the figure below. The mass is free to slide on the horizontal smooth surface of the box, so that there is no friction between the block and the surface. If the box suddenly starts accelerating in the x- direction with acceleration $\mathbf{a}$, find the resulting motion of the mass m. (Take the point where the spring is attached to be x=0) **1 point**



- $x(t) = l + \frac{ma}{k} \cos \sqrt{\frac{k}{m}} t$
- $x(t) = -l + \frac{ma}{k} \cos \sqrt{\frac{k}{m}} t$
- $x(t) = l + \frac{2ma}{k} \cos \sqrt{\frac{k}{m}} t$
- $x(t) = -l + \frac{3ma}{k} \cos \sqrt{\frac{k}{m}} t$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$x(t) = -l + \frac{ma}{k} \cos \sqrt{\frac{k}{m}} t$

11)A car standing with its door open perpendicular to it. The car suddenly starts accelerating with an acceleration **a**. What will be the angular speed of the door when it closes. The door can be taken to be square of length w and mass M. **1 point**

- $\omega = \sqrt{3a/w}$
- $\omega = \sqrt{5a/w}$
- $\omega = \sqrt{7a/w}$
- $\omega = \sqrt{9a/w}$

No, the answer is incorrect.
Score: 0

Accepted Answers:

$\omega = \sqrt{3a/w}$

12) Sometimes when a motorcycle is accelerated by large accelerations, its front wheel lifts off the ground. Assuming the mass of motorcycle is *M* and its center of gravity lies *h* distance above the ground and the distance between the wheel being *b*, The acceleration at which the front wheel lifts is **1 point**

- $a = \frac{gb}{2h}$
- $a = \frac{3gb}{2h}$
- $a = \frac{5gb}{2h}$
- $a = \frac{5gb}{5h}$

No, the answer is incorrect.
Score: 0

Accepted Answers:

$a = \frac{gb}{2h}$

13) A rocket is on a horizontal launching platform. There is a pendulum hanging from it. When the rocket is fired, its acceleration *a* is such that the pendulum starts oscillating with its other extreme position being at an angle from the vertical. Then the value of *a* in terms of the gravitational acceleration g is **1 point**

- $a = g\sqrt{1/3}$
- $a = g\sqrt{2/3}$
- $a = g\sqrt{3}$
- $a = g\sqrt{7/3}$

No, the answer is incorrect.
Score: 0

Accepted Answers:

$a = g\sqrt{1/3}$

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