Week 6 Assignment

The due date for submitting this assignment has passed. Due on 2018-03-21, 23:59 IST.
As per our records you have not submitted this assignment.

This assignment contains 10 questions. Each question has individual marks.

1) When a two-degree-of-freedom system is subjected to a harmonic force, the system vibrates at the
   - frequency of applied force
   - smaller natural frequency
   - larger natural frequency
   - none

No, the answer is incorrect.
Score: 0
Accepted Answers:
frequency of applied force

2) Find the natural frequencies of the following system for \( k_1 = k_2 = k_3 = k \), and \( m_1 = m_2 = m \)

\[
\omega_1 = \sqrt{k/m}, \quad \omega_2 = \sqrt{3k/m}
\]

\[
\omega_1 = \sqrt{2k/m}, \quad \omega_2 = \sqrt{3k/m}
\]

\[
\omega_1 = \sqrt{3k/m}, \quad \omega_2 = \sqrt{2k/m}
\]

\[
\omega_1 = \sqrt{3k/2m}, \quad \omega_2 = \sqrt{2k/m}
\]

No, the answer is incorrect.
Score: 0
Accepted Answers:
\( \omega_1 = \sqrt{k/m}, \omega_2 = \sqrt{3k/m} \)

3) Using the figure of Q.02. Find the natural frequencies (rad/second) of the system shown in figure for \( m_1 = 2 \text{ kg}, m_2 = 5 \text{ kg}, k_1 = k_2 = 3 \text{ N/m}, \text{ and } k_3 = 4 \text{ N/m} \).

\[
\omega_1 = 0.2, \quad \omega_2 = 3.854
\]

\[
\omega_1 = 2.74, \quad \omega_2 = 3.02
\]
4) Find the natural frequency of the system as shown in the figure below for \( m_1 = 3 \text{ kg}, m_2 = 6 \text{ kg}, \) and \( k = 250 \text{ N/m}. \)

\[ \omega_1 = 0.979, \omega_2 = 1.854 \]

No, the answer is incorrect.
Score: 0
Accepted Answers:
\[ \omega_1 = 0.979, \omega_2 = 1.854 \]

5) Using the figure of Q.4. Find the mode shape of the system

\[ X_1 = \begin{bmatrix} 1 \\ 1.5 \end{bmatrix}, \quad X_2 = \begin{bmatrix} 1 \\ -0.78 \end{bmatrix} \]

No, the answer is incorrect.
Score: 0
Accepted Answers:
\[ X_1 = \begin{bmatrix} 1 \\ 1.5 \end{bmatrix}, \quad X_2 = \begin{bmatrix} 1 \\ -0.51 \end{bmatrix} \]

\[ \begin{bmatrix} 1 \\ 0.86 \end{bmatrix}, \quad X_2 = \begin{bmatrix} 1 \\ -0.78 \end{bmatrix} \]

\[ \begin{bmatrix} 1 \\ 1 \end{bmatrix}, \quad X_2 = \begin{bmatrix} 1 \\ -0.87 \end{bmatrix} \]

No, the answer is incorrect.
Score: 0
Accepted Answers:
\[ \begin{bmatrix} 1 \\ 1 \end{bmatrix}, \quad X_2 = \begin{bmatrix} 1 \\ -0.87 \end{bmatrix} \]

6) A machine tool, having a mass of 1000 kg and a mass moment of inertia of \( J_0 = 300 \text{ kg-m}^2 \) is supported on elastic supports, as shown in Figure given below. If the stiffness of the support is given by 3000 N/mm and 2000 N/mm, and the supports are located at 0.5 m and 0.8 m, find the natural frequencies.
ω₁ = 110, ω₂ = 40.18
ω₁ = 50, ω₂ = 39.57
ω₁ = 70.57, ω₂ = 82.373
ω₁ = 0, ω₂ = 85.32

No, the answer is incorrect.
Score: 0
Accepted Answers:
ω₁ = 70.57, ω₂ = 82.373

7) Using Q.6, find the mode shapes of the machine tool.

\[ X_1 = \begin{bmatrix} 1 \\ 1.5 \end{bmatrix}, \quad X_2 = \begin{bmatrix} 1 \\ -0.78 \end{bmatrix} \]

\[ X_1 = \begin{bmatrix} 1 \\ -5.34 \end{bmatrix}, \quad X_2 = \begin{bmatrix} 1 \\ 0.056 \end{bmatrix} \]

\[ X_1 = \begin{bmatrix} 1 \\ 0.86 \end{bmatrix}, \quad X_2 = \begin{bmatrix} 1 \\ -0.75 \end{bmatrix} \]

\[ X_1 = \begin{bmatrix} 1 \\ 1 \end{bmatrix}, \quad X_2 = \begin{bmatrix} 1 \\ -0.87 \end{bmatrix} \]

No, the answer is incorrect.
Score: 0
Accepted Answers:
\[ X_1 = \begin{bmatrix} 1 \\ -5.34 \end{bmatrix}, \quad X_2 = \begin{bmatrix} 1 \\ 0.056 \end{bmatrix} \]

8) Figure shows a vibrating system having two degree of freedom. The ratio of amplitudes of the motion of \( m_1 \) and \( m_2 \) for the two mode of the vibration. Given: \( m_1 = 1.5 \text{ kg and } m_2 = 0.8 \text{ kg and } k_1 = k_2 = 40 \text{ N/m} \).

-0.765, 0.696
2.56, 0.456
6.450, 0.969
0.569, 4.547

No, the answer is incorrect.
Score: 0
Accepted Answers:
-0.765, 0.696

9) In the system shown in the figure, the mass \( m_1 \) is excited by a harmonic force \( 40\sin(4\pi t) \text{ N} \). Find the forced amplitude (in mm) of each mass for \( m_1 = 15 \text{ kg, } m_2 = 10 \text{ kg, } k_1 = 6000 \text{ N/m, and } k_2 = 1500 \text{ N/m} \).

\[ X_1 = 14.25, \quad X_2 = 56.4 \]
The mass and stiffness matrices and the mode shapes of a two-degree-of-freedom system are given by

\[
\begin{pmatrix}
12 & 2.4 & 1.581 \\
24 & 5.4 & 2.58 \\
28 & 6 & 8.5 \\
17 & 7 & 3.5
\end{pmatrix}
\]

No, the answer is incorrect.
Score: 0
Accepted Answers:
12, 2.4, 1.581