1. What type of vibration occurs when a system is subjected to a harmonic force with a single degree of freedom?

a) Random vibration
b) Free vibration
c) Forced vibration
d) Transient vibration

Answer: c) Forced vibration
Explanation: Forced vibration occurs when a system is subjected to an external harmonic force, causing it to oscillate with a frequency determined by the forcing function.

2. How can forces in a harmonically excited vibration system be represented?

a) Scalar
b) Matrix
c) Vector
d) Tensor

Answer: c) Vector
Explanation: Forces in a harmonically excited vibration system, such as those due to rotating and reciprocating unbalance, are typically represented as vectors because they have both magnitude and direction.

3. What property of a vibration isolation system determines its effectiveness in reducing transmitted forces and motions?

a) Stiffness

b) Damping
c) Mass
d) Friction

Answer: a) Stiffness
Explanation: The stiffness of a vibration isolation system determines how much it deflects under a given load, thus affecting its ability to isolate vibrations from being transmitted to other parts of the system.

4. Which type of motion do seismic instruments primarily measure?

a) Translational motion
b) Rotational motion
c) Harmonic motion
d) Oscillatory motion

Answer: a) Translational motion
Explanation: Seismic instruments are primarily designed to measure the translational motion of the ground during seismic events such as earthquakes.

5. What is the significance of critical speed in the context of whirling motion?

a) It indicates the maximum speed a system can achieve.
b) It marks the onset of instability in rotating machinery.
c) It determines the resonant frequency of the system.
d) It represents the natural frequency of vibration in a structure.

Answer: b) It marks the onset of instability in rotating machinery.

Explanation: Critical speed is the rotational speed at which a rotating system experiences resonance and becomes prone to instability, leading to potentially damaging whirling motion.

6. Define critical speed in the context of a vertical, light, flexible shaft with a single rotor.

a) The maximum speed the shaft can withstand without bending.
b) The speed at which the rotor becomes unbalanced.
c) The speed at which resonance occurs in the shaft system.
d) The rotational speed at which the shaft experiences instability due to its natural frequency.

Answer: d) The rotational speed at which the shaft experiences instability due to its natural frequency.
Explanation: Critical speed in this context refers to the rotational speed at which the shaft experiences resonance and instability due to its own natural frequency, potentially leading to whirling motion.

7. How does damping affect the critical speed of a flexible shaft with a single rotor?

a) Damping has no effect on critical speed.
b) Higher damping increases critical speed.
c) Higher damping decreases critical speed.
d) Damping stabilizes the system, eliminating critical speed.

Answer: c) Higher damping decreases critical speed.
Explanation: Higher damping in the system dissipates energy, reducing the magnitude of vibrations and thus lowering the critical speed at which instability occurs.

8. What is the secondary critical speed of a shaft carrying multiple discs?

a) The speed at which the secondary resonance occurs.
b) The speed at which the first critical speed is surpassed.
c) The speed at which torsional vibrations occur.
d) The speed at which the system exhibits multiple unstable modes.

Answer: d) The speed at which the system exhibits multiple unstable modes.
Explanation: The secondary critical speed is a rotational speed at which a shaft carrying multiple discs experiences additional modes of instability, beyond the primary critical speed.

9. Which type of motion is associated with whirling motion in rotating machinery?

a) Linear
b) Circular
c) Translational
d) Oscillatory

Answer: b) Circular
Explanation: Whirling motion involves circular motion in rotating machinery, where the center of rotation is not fixed but moves in a circular path.

10. What happens to the stiffness of a shaft as it approaches its critical speed?

a) Stiffness decreases
b) Stiffness increases
c) Stiffness remains constant
d) Stiffness becomes infinite

Answer: a) Stiffness decreases

Explanation: As a shaft approaches its critical speed, its effective stiffness decreases due to factors such as centrifugal forces and gyroscopic effects, contributing to instability.

11. In a forced harmonic vibration system, what determines the frequency of the system's response?

a) Damping ratio
b) Amplitude of the forcing function
c) Natural frequency of the system
d) Mass of the system

Answer: c) Natural frequency of the system
Explanation: The frequency of the system's response in forced harmonic vibration is determined by its natural frequency, which is an inherent property of the system and remains constant.

12. How does the presence of multiple discs affect the critical speed of a shaft?

a) Increases critical speed
b) Decreases critical speed
c) Does not affect critical speed
d) Introduces secondary critical speeds

Answer: d) Introduces secondary critical speeds
Explanation: The presence of multiple discs introduces additional modes of instability, leading to secondary critical speeds beyond the primary critical speed of the shaft.

13. What is the primary purpose of vibration isolation systems?

a) To amplify vibrations
b) To reduce transmitted forces and motions
c) To increase structural stiffness
d) To introduce damping into the system

Answer: b) To reduce transmitted forces and motions
Explanation: Vibration isolation systems are designed to reduce the transmission of vibrations from one part of a system to another, thus minimizing the impact of vibrations on surrounding components.

14. Which characteristic of a shaft determines its critical speed in the absence of damping?

a) Length
b) Diameter
c) Material composition
d) Stiffness

Answer: d) Stiffness
Explanation: In the absence of damping, the critical speed of a shaft is primarily determined by its stiffness, as this influences its natural frequency of vibration.

15. What is the primary factor influencing the magnitude of motion transmitted through a vibration isolation system?

a) Stiffness of the system
b) Damping of the system
c) Mass of the system
d) Frequency of the excitation

Answer: a) Stiffness of the system
Explanation: The stiffness of a vibration isolation system plays a significant role in determining the magnitude of motion transmitted through it, with higher stiffness leading to greater isolation effectiveness.

16. What phenomenon occurs when the excitation frequency matches the natural frequency of a vibrating system?

a) Forced vibration
b) Resonance
c) Damping
d) Isolation

Answer: b) Resonance
Explanation: Resonance occurs when the excitation frequency of a vibrating system matches its natural frequency, resulting in amplified vibrations and potentially detrimental effects.

17. What is the primary function of seismic instruments?

a) To measure vibration isolation effectiveness
b) To detect earthquakes
c) To monitor critical speeds in rotating machinery
d) To measure forces transmitted through a system

Answer: b) To detect earthquakes
Explanation: Seismic instruments are primarily used to detect and measure seismic waves generated by earthquakes, allowing for monitoring and analysis of seismic activity.

18. How does damping affect the motion transmissibility of a vibration isolation system?

a) Damping increases motion transmissibility
b) Damping decreases motion transmissibility
c) Damping has no effect on motion transmissibility
d) Damping introduces secondary critical speeds

Answer: b) Damping decreases motion transmissibility
Explanation: Damping in a vibration isolation system reduces the magnitude of transmitted vibrations, thereby decreasing motion transmissibility and improving isolation effectiveness.

19. What characteristic of a vibrating system determines its natural frequency?

a) Stiffness
b) Damping
c) Mass
d) Frequency of excitation

Answer: a) Stiffness
Explanation: The natural frequency of a vibrating system is primarily determined by its stiffness, representing the frequency at which it naturally oscillates in the absence of external forces.

20. In the context of vibration isolation, what does motion transmissibility refer to?

a) The ability of a system to withstand external forces
b) The percentage of motion transmitted through a vibration isolation system
c) The conversion of translational motion into rotational motion

d) The rate at which vibrations decay over time

Answer: b) The percentage of motion transmitted through a vibration isolation system
Explanation: Motion transmissibility quantifies the effectiveness of a vibration isolation system by indicating the percentage of motion transmitted through it relative to the input motion.

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