

B. Voc.
T.Y. (Automobile Servicing)
Auto NVH (Semester - V)

1. **Free Vibrations occur in the absence of an external excitation**
a) Yes b) No
2. **Free Vibrations are the result of a kinetic energy imparted to the system**
a) True b) False
3. **The undamped natural frequency depends on initial conditions of motion.**
a) True b) False
4. **Why is the study of vibrations strongly recommended?**
a) to stop the mechanical systems b) to stop the structural systems
c) to help the mechanical systems to vibrate more
d) to identify the result of Oscillations of any structural or mechanical system
5. **What is used to protect structures from excessive forces developed in the operation of rotary machinery?**
a) Vibration insulator b) Vehicle suspension system c) Vibrations isolators
d) Cushioning
6. **If the vibrations are initiated by an initial energy present in the system and no other source is present, the resulting vibrations are called?**
a) Free vibrations b) Random vibrations c) Transient vibrations d) Forced vibrations
7. **Which of the following is an example for free Vibration?**
a) Oscillations arise in the machines such as diesel engines
b) Oscillation of simple pendulum c) Electric bells d) Machine tools
8. **When does resonance occur?**
a) The external excitation has a lower frequency as that of the natural frequency of the system
b) The external excitation has zero frequency
c) The external excitation has the same frequency as that of the natural frequency of the system
d) The external excitation has a higher frequency as that of the natural frequency of the system
9. **Degrees of Freedom can be defined as number of required independent coordinates to describe a vibratory system.**
a) No b) Yes
10. **If the motion is repeated after equal intervals of time, it is called———motion**
a) Aperiodic motion b) continuous motion c) Periodic motion d) constrained motion
11. **Vibrations occurs in all bodies which are having mass and elasticity**
a) True b) False
12. **Which is used to protect passengers from uncomfortable situation when moving over rough land?**
a) Vehicle lubrication system b) Vehicle cooling system c) Vehicle pumping system
d) Vehicle suspension system
13. **Which of the following term indicates the time taken to complete one cycle?**
a) Resonance b) Time period c) Phase period d) Amplitude
14. **The Linear differential equation is the one**
a) which does not obey the law of superposition
b) which is governed by the linear vibration

- c) which is not governed by the linear vibrations
- d) which is governed by the non-linear vibrations

15. The Study of Vibrations is strongly recommended

- a) to identify the result of Oscillations of any structural or mechanical system
- b) to help the mechanical systems to vibrate more
- c) to stop the structural systems
- d) to stop the mechanical systems

16. Vibration in any automobile systems

- a) does not cause any problems
- b) causes unbalance in automotive engines
- c) increase in fuel economy of engines
- d) speed up the engine

17. Vibrations are one of the reason for failure of Bridges

- a) Yes
- b) No

18. The study of vibrations starts with _____ of vibrating systems

- a) Mathematical modeling
- b) Experimental modeling
- c) Analytical modeling
- d) Bio mechanical modeling

19. A vibrometer indicates

- a) Amplitude
- b) Frequency
- c) time Period
- d) None of these

20. The vibration in a vehicle is normally expressed in the terms of the _____

- A Displacement
- B. Velocity
- C. Acceleration
- D. Time

Q.1) What is undamped single degree of freedom systems? (2)

SOLUTION:

If there is no external force applied on the system, $f(t) = 0$ the system will experience *free vibration*. Motion of the system will be established by an initial disturbance (i.e. initial conditions).

Q.2) What is linear motion? (2)

SOLUTION: Linear motion is a change in position from one point to another in a straight line in one dimension. Some examples of linear motion are the motion of a car on a straight road, freefall of objects, and bowling.

Q.3) Describe natural frequency? (2)

SOLUTION:

The natural frequency in cycles/second or Hz is

$$f_n = \omega_n / 2\pi$$

The natural frequency is the frequency at which the system would oscillate if it were given an initial displacement and then allowed to vibrate freely. The period T is the inverse of the natural frequency.

$$T = 1 / f_n$$

The angular natural frequency in radians/sec is

$$\omega_n = \sqrt{k/m}$$

- Q.4) a) What is damped single degree of freedom systems? (3)
SOLUTION:

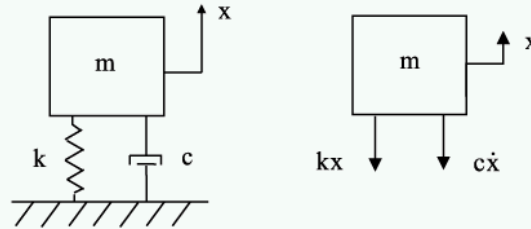


Figure 1.1. Single-degree-of-Freedom System, Spring-Mass Model

The mass value is m . The viscous damping coefficient is c . The spring stiffness from Hooke's law is k . The displacement is x . The velocity is \dot{x} .

$$m \ddot{x} + c \dot{x} + kx = 0$$

A mass is attached to a spring and a damper, which are both fixed at the opposite end. The system starts with some initial displacement and velocity, although usually, the initial velocity is zero.

- Q.5) What is the natural frequency of a torsional system? (2)

SOLUTION:

A torsional natural frequency of a mechanical system is a frequency at which the inertia and stiffness torques are completely in balance. In the absence of damping in the system, forcing the mechanical system at this frequency would generally result in a theoretical infinite vibration response.

- Q.6) What is an example of an undamped oscillation system? (2)

SOLUTION: A bob of a simple pendulum displaced in a vacuum as there is no resistance to damp the amplitude.

Amplitude of oscillation decreases with time. There is presence of air friction.

- Q.7) a) What are different types of dampers in vibration system? (3)

SOLUTION:

Viscous Dampers: These dampers are used to protect buildings and bridges from earthquakes.

Friction Dampers: These dampers are made up of steel plates that slide against each other in opposite directions. The friction between the plates dissipates energy.

Tuned Mass Damper (TMD): These dampers are also known as tuned vibration absorbers. They can absorb vibration at a selected tuned frequency.

Yielding Dampers: These components are inexpensive and can absorb a large amount of energy.

Q.8) a) What Is centrifugal pendulum? (3)

SOLUTION:

A centrifugal pendulum absorber (CPA) is a type of tuned mass damper. It's a device that reduces the amplitude of torsional vibrations in drive trains that use a combustion engine.

A centrifugal pendulum vibration absorber (CPVA) is a widely used device that isolates torsional vibrations in rotating and reciprocating machinery.

CPVAs counteract torque disturbance at a given harmonic order by oscillating along a prescribed path.

Q.9) What is untuned viscous damper? (2)

SOLUTION:

Viscous damping is the dissipation of energy that occurs when a force resists a particle in a vibrating system. The force is proportional to the velocity of the system, so the faster the mass moves, the more damping force resists it.

Viscous dampers are also known as seismic dampers. They are hydraulic devices that dissipate the kinetic energy of seismic events and cushion the impact between structures.

Q.10) What is vibration isolation? (2)

SOLUTION:

Vibration isolation is a technique that prevents vibration from being transmitted from one component of a system to another. It can be used to protect delicate objects from excessive vibration or to prevent machines from transmitting vibrations to their surroundings.

Q.11) What are the frequency measuring instruments in vibration? (3)

SOLUTION:

1. Vibrometer:

A portable device that measures the vibration level of a machine or its components.

A Vibrometer or seismometer is used for measuring displacement of a vibrating body. Basically it is design under the condition of low natural frequency due to this reason it is also called as low frequency transducer.

2. Accelerometer:

A small device that measures, displays, and analyzes vibration and acceleration.

Accelerometers measure vibration by monitoring acceleration and converting it into voltage. They are usually mounted on equipment to measure vibration on machines operating at greater than 60 Hz. On machines at 60 Hz or less an accelerometer integrated to velocity is usually used to identify any irregularities.

3. Frequency meter:

A device that measures the repetitions per unit of time of a complete electromagnetic waveform. A frequency meter is an instrument that displays the frequency of a periodic electrical signal.

Q.12) What is used in an engine to avoid crankshaft torsional vibration? (2)

SOLUTION:

Torsional vibration affects all engines and is caused by the pulsating torque applied to the crankshaft from the firing of each cylinder. The crankshaft actually twists back and forth slightly with each stroke. This vibration is especially present in diesel engines, due to their high compression ratios.

Torsional vibration dampers mounted on the front of the crankshaft are common methods for reducing dynamic loads.

Q.13) What is an example of a torsional vibration? (2)

SOLUTION:

Torsional vibration involves speed fluctuations of various components and the twisting of shaft sections while the machinery is rotating. Excessive torsional vibration can lead to failures of such items as shafts, couplings, fans, gears, engine dampers, and compressor oil pumps.

Crankshaft: The crankshaft speeds up a little each time a cylinder fires. However, it slows down between each combustion event due to its inertia properties. This non-constant rotational speed is the torsional vibration.

Ship's propulsion shafting: The torsional vibration of the ship's propulsion shafting is caused by periodic torque excitation, such as the diesel engine and propeller.

Rod: Twisting the end of a rod will give rise to a torsional wave.

Q.14) What is the working principle of vibration measurement in flow chart?

SOLUTION:

