



Review Paper 1

1. Vibration in a general sense is:

- a) Periodic motion
- b) Aperiodic motion
- c) May be periodic or aperiodic
- d) May be periodic and aperiodic

2. The Amplitude of vibration is

- a) independent of the time period of vibration
- b) dependent on the time period of vibration
- c) independent of the phase of vibration
- d) dependent on the phase of vibration

3. The amplitude of vibration is measured in

- a) Displacement
- b) Displacement, velocity
- c) Displacement, velocity, acceleration
- d) Displacement, velocity, acceleration and phase

4. Strain Energy of a system is always proportional to:

- a) Displacement
- b) Velocity
- c) Acceleration
- d) Phase

5. Velocity measurement tells us the:

- a) Amount of energy wastage in the system
- b) Amount of energy in the system
- c) RMS value of the vibration
- d) None of the above

6. For understanding the problems of antifriction bearings, we often measure vibration in terms of:

- a) Velocity
- b) Acceleration
- c) Special form of acceleration
- d) Spike energy

7. For understanding the problem of journal bearings it is often best to measure vibration in:

- a) Displacement
- b) Spike Energy
- c) Enveloped signal of velocity
- d) Acceleration



8. For slow moving machines it is better to measure vibration in

- a) Velocity
- b) Acceleration
- c) Velocity and acceleration
- d) Displacement

9. For structures it is better to measure vibration in:

- a) Velocity
- b) Acceleration
- c) Velocity and acceleration
- d) Displacement and acceleration

10. We use time waveform to understand:

- a) The frequency of vibration
- b) The pattern of vibration
- c) Energy losses in the system
- d) The primary frequencies involved

11. Any body vibrates because it has:

- a) Mass
- b) Mass and stiffness
- c) Mass, stiffness and damping
- d) Mass, stiffness and elasticity

12. The human finger can pick up vibrations of about:

- a) 100 microns
- b) 1000 microns
- c) 10 microns
- d) 60 microns

13. The choice of vibration parameter and the vibration technique depend on:

- a) The type of vibration faults we would like to pick up
- b) It does not matter so long we are able to pick up some type of vibration signals
- c) The type of machine we are monitoring
- d) The limitation of our instrumentation

14. Which of the following types of vibration we can't measure by our present instrumentation:

- a) Longitudinal vibration
- b) Lateral vibrations
- c) Radial vibrations
- d) Torsional vibrations



Review Paper 2

1. The stiffness of the spring is:
 - a) Proportional to the strength of the material of the spring
 - b) Proportional to the Force/deflection
 - c) Proportional to the deflection of the spring
 - d) Proportional to the weight acting on the spring

2. If a spring of stiffness 'K' is cut into two then the spring stiffness is equal to:
 - a) $K/2$
 - b) K
 - c) $2K$
 - d) $K - k$

3. If a machine is mounted on 4 springs having equal stiffness of 'K' each then the combined stiffness of the system is:
 - a) K
 - b) $3K$
 - c) $K/4$
 - d) $4K$

4. At low speeds damping is proportional to:
 - a) velocity
 - b) square of the velocity
 - c) force imposed on the system
 - d) elasticity of the material

5. A body has:
 - a) One natural frequency
 - b) A finite number of natural frequencies
 - c) Infinite number of natural frequencies
 - d) Depends on the moment of inertia of the body

6. The natural frequency of a body can be expressed as:
 - a) $\sqrt{k/m}$, where k is the stiffness and m is the mass of the body
 - b) $\sqrt{m/k}$
 - c) $m \times k \times g$, where g is the acceleration due to gravity
 - d) $2\pi/n$, where n is the rpm of the rotating body

7. Vibrations tend to increase as machines operate at:
 - a) near natural frequency
 - b) at natural frequency
 - c) near or at natural frequency
 - d) beyond 1.141 times the natural frequency



8. At resonance the amplitude of vibration does not reach infinity because:

- a) There is always a limit to vibration
- b) Damping is always present
- c) All materials have some amount of stiffness
- d) Of the quality factor in resonant conditions

9. Vibrations measured in terms of displacement would tend to increase:

- a) If the body has lower stiffness
- b) If the body has higher mass
- c) If the body has more damping
- d) If the body is struck by impact forces

10. The first mode of vibration has:

- a) Two nodes in the mode shape
- b) Multiple nodes in the mode shape
- c) One node in the mode shape
- d) No nodes are observed

11. Higher the frequency of vibration:

- a) Less is the damping of the signal
- b) Higher the damping of the signal
- c) Less is the energy content in the signal
- d) Less the moment of inertia of the system

12. The causes of vibration are:

- a) Force and stiffness
- b) Mass and stiffness
- c) Force and Space
- d) Force and mass

13. We can correct any type of vibration problem by adjusting the:

- a) Mass
- b) Stiffness
- c) Damping
- d) All of the above

14. The pipelines in a turbine generator machine can act as:

- a) Additional mass to the system
- b) Additional Springs
- c) Increases the damping in the system
- d) Elements that increase the rigidity of the system



Review Paper 3

1. Low frequency vibrations:

- a) Easily get damped
- b) Travel a long distance
- c) Passes on its energy to other vibrations
- d) Rarely occur in real life systems

2. A machine vibrates in different directions only because:

- a) System rigidity is different in different directions
- b) Force imposed on the system is different in different directions
- c) The space to vibrate is different in different directions
- d) All of the above

3. Beat phenomenon can exist when:

- a) Two frequencies of vibrations are wide apart but their intensities are almost the same
- b) Two frequencies of vibrations are nearly equal and their intensities are almost the same
- c) Three or more frequencies of vibrations are mixed up with varying intensities of vibration
- d) A disturbing frequency is present having a large intensity of vibration

4. A Beat phenomenon can be observed very well:

- a) In a Time waveform
- b) In a frequency spectrum
- c) In overall measurements
- d) In both time and frequency measurements

5. Overall vibration measurements are measured up to:

- a) 1000 Hz
- b) 100 Hz
- c) 60, 000 CPM
- d) 1, 20, 000 CPM

6. With the help of an accelerometer we would be able to measure up to:

- a) Any frequency range
- b) Up to 80, 000 CPM
- c) Up to the resonant frequency of the accelerometer
- d) Up to the last frequency generated by the defective bearing

7. We can measure vibration in terms of velocity by using:

- a) Eddy current probes
- b) Accelerometer
- c) Velocity pickups
- d) Velocity pickups and accelerometers



8. The best option to reduce abnormal vibration in a rotating machine is to:

- a) Balance the rotor
- b) Align the shaft
- c) Change the bearing
- d) Don't know

9. Vibration measurements are generally taken on bearing housings because:

- a) They don't rotate
- b) The forces pass through the bearings
- c) Bearing defects are best monitored by being as close to the bearing as possible
- d) All of the above

10. Vibration measured in terms of displacement is in:

- a) Peak value
- b) Peak to Peak value
- c) RMS
- d) Average value

11. Journal bearing conditions can best be understood by:

- a) Acceleration values
- b) Displacement values
- c) Velocity values
- d) All of the above

12. Anti-friction bearing conditions can best be understood by

- a) Acceleration values
- b) Displacement values
- c) Velocity values
- d) All of the above

13. As anti-friction bearing condition deteriorates:

- a) The peak velocity values generally tend to increase in relation to velocity measured in rms
- b) The peak acceleration values generally tend to increase in relation to velocity measured in rms
- c) The displacement values generally tend to decrease in relation to velocity measured in rms
- d) All of the above occur

14. Bad anti-friction bearings produce:

- a) High frequency vibrations
- b) Vibration at different frequencies
- c) Vibrations at special frequencies
- d) All of the above



Review Paper 4

1. A harmonic motion is described by the equation $x = A \sin \omega t$: where A represents:
 - a) Maximum amplitude
 - b) The average amplitude
 - c) A constant
 - d) The rms value of the amplitude

2. Two vibrations $x_1 = 3 \sin 40t$ and $x_2 = 4 \sin 41t$ are simultaneously acting on a body. The maximum and minimum amplitude of the combined vibration would be: (the 1st figure represents the maximum while the 2nd figure represents the minimum amplitude)
 - a) 7 units, 3 units
 - b) 4 units, 3 units
 - c) 7 units, 1 unit
 - d) 3 units, 1 unit

3. For the same question as above, the time period T would be:
 - a) 6 seconds
 - b) 6.28 seconds
 - c) 5 seconds
 - d) 7 seconds

4. When a turbo-generator is connected to the line we would:
 - a) Hear a beat
 - b) Hear a 'magnetic hum'
 - c) Get higher vibration levels
 - d) Get no appreciable changes in vibration

5. The study of frequencies in a vibration signature tells us the:
 - a) The source of the problem
 - b) The severity of the problem
 - c) Both the source and severity of the problem
 - d) Tells nothing in particular

6. In a vibration signature, we use phase to:
 - a) To find the stability of the system
 - b) To confirm whether the system is in resonance
 - c) To confirm whether there is a crack growth in a shaft
 - d) To do nothing in particular

7. Any significant change in the machinery condition would always be reflected by:
 - a) Changes in the higher frequency regions
 - b) Changes in the bearing frequencies and amplitude
 - c) Changes in the 1 x RPM peak of the signature
 - d) A significant increase in amplitude of any peak.



8. A crack developing in a turbine shaft is indicated changes in the 2 x RPM peak because:

- a) The stiffness changes as the crack develops
- b) The shaft gets misaligned
- c) The residual unbalance is triggered
- d) Lateral forces are developed

9. Excessive clearance in a journal bearing would:

- a) Increase the vibration levels only
- b) Increase the vibration levels and the bearing temperature
- c) Decrease the vibration levels but increase the bearing temperature
- d) Increase the noise level of the bearing

10. Unbalance in rotating machinery can be confirmed if:

- a) Amplitude of 1 x N frequency is quite high relative to other peaks.
- b) Amplitude of 2 x N frequency is quite high relative to other peaks
- c) If difference in phase angle in the vertical and horizontal plane differs by 90 degrees
- d) Amplitude of 1 x N is high, other peaks are absent and phase angle difference two radial planes is 90 degrees

11. If the geometrical position of a mechanical system at any instant can be expressed by one number then

- a) The system has two degrees of freedom
- b) The system has one degree of freedom
- c) The system has many degrees of freedom
- d) We need more data to decide the degree of freedom

12. A piston moving in a cylinder is an example of:

- a) One degree of freedom
- b) Two degrees of freedom
- c) Four degrees of freedom
- d) Six degrees of freedom

13. A rigid body moving freely through space has around:

- a) Three degrees of freedom
- b) Six degrees of freedom
- c) N degrees of freedom
- d) One degree of freedom

14. A car body mounted on flexible springs has:

- a) One degree of freedom
- b) Six degrees of freedom
- c) Two degrees of freedom
- d) Seven degrees of freedom



Review Paper 5

1. A beam supported at two ends has:

- a) One degree of freedom
- b) Two degrees of freedom
- c) Three degrees of freedom
- d) Infinite degrees of freedom

2. Viscous damping is:

- a) Always proportional to displacement and acts in the opposite direction of displacement
- b) Always proportional to velocity and acts in the same direction of velocity
- c) Always proportional to velocity and acts in the opposite direction of velocity
- d) Always proportional to the acceleration and acts opposite to the direction of acceleration

3. Dry damping or drag is:

- a) Proportional to the speed
- b) Proportional to the velocity
- c) Proportional to the square of velocity
- d) None of the above

4. The electrical equivalent of mechanical damping (viscous) is:

- a) 1/Capacitance
- b) Capacitance
- c) Resistance
- d) Inductance

5. Very high frequency vibrations are measured with:

- a) Eddy current probes
- b) Velocity pickups
- c) Accelerometers
- d) Superconductors

6. The natural frequency of any structure might be altered by the use of:

- a) Force and stress
- b) Stiffness and Damping
- c) Stiffness or Mass or Moment of Inertia or in combination
- d) Damping

7. For a rigid system the critical speed is:

- a) Below the operating speed
- b) Above the operating speed
- c) Equal to the operating speed
- d) Has no direct relationship to the operating speed



8. Rubbing in a system gives rise to:

- a) Periodic and harmonic vibrations
- b) Aperiodic vibrations
- c) Harmonics of the fundamental frequency
- d) Sub-harmonic vibration of the fundamental frequency

9. Vibration severity levels (as per ISO classification) are based on:

- a) Amplitudes
- b) Frequency and KW
- c) Amplitude and frequency
- d) Amplitude and KW

10. The main causes of vibration are:

- a) Forces applied on a body in different directions
- b) Forces applied on a body and space
- c) Acceleration and deceleration
- d) Looseness

11. Base line signature or overall vibration level tells us that:

- a) The machine is in good working condition
- b) The machine needs a check up after sometime
- c) The machine is in working condition but is unhealthy
- d) The machine needs to be stopped immediately for repairs

12. A vibration monitoring program is based on our understanding of:

- a) Overall vibrations
- b) Frequency or signature analysis
- c) Simple Trend analysis
- d) Time wave forms

13. A plant predictive maintenance program is based on:

- a) Essentially Vibration Monitoring Program
- b) Vibration and other instrument based Condition Monitoring techniques
- c) Vibration and Oil Analysis
- d) Instrument Based Condition Monitoring Techniques and Visual monitoring

14. The frequency of monitoring of any critical machine should be:

- a) At least once a month
- b) Once a fortnight
- c) Equal to the MTBF (Mean Time Between Failures) of the machine
- d) Equal to MTBF/5 (hours/days)



Review Paper 6

1. Vibration Monitoring and Predictive maintenance techniques should be applied to failure modes:

- a) That occur randomly
- b) That happen too often
- c) That are age related
- d) All of the above

2. Vibration levels at the foundation of a rotating machine should be:

- a) More or less equal to the vibration levels measured on the bearing housings
- b) Around half the vibration levels measured on the bearing housings
- c) Way below the vibration levels measured on the bearing housings by an order of 4 to 5
- d) More than the vibration levels measured on the bearing housings

3. Axial vibration is:

- a) Always a result of misalignment
- b) Due to bent shafts
- c) Due to unbalance of overhung fans
- d) May indicate many other problems

4. In a gear box the vibration signals as seen in a frequency spectrum:

- a) Get mixed up
- b) Remain distinctly separate from each other
- c) Mutually affect the vibration signals of each other
- d) Bearing signals get embedded in the Gear Mesh signals

5. In an acceleration signature the amplitude of vibration is:

- a) Proportional to the square of the angular speed
- b) Proportional to the frequency
- c) Proportional to the degree of defect
- d) None of the above

6. The upper limit of frequency that can be measured in a frequency spectrum depends on the:

- a) The range specified by the manufacturer
- b) The range of frequency generated by the machine
- c) The limit set by ISO for overall vibration levels, i.e. 1000 Hz
- d) The resonant frequency of the probe

7. Usually the number of averages taken to capture a signature varies between:

- a) 1 to 4
- b) 4 to 8
- c) 8 to 12
- d) 12 to 16



8. The problem of using Hanning windows is that we lose part of the signal and thus information:
- Around the skirt area of the frequency peak
 - Around the top of the frequency peak.
 - Around the sides of the frequency peak
 - Around the middle of the frequency peak
9. We use a 'flat top' window when we are interested to:
- Gather information about natural frequencies, critical speeds and side bands
 - Make an estimate about the amount of damping present in the system
 - See the full frequency range
 - Understand the amplitudes more accurately
10. The amplitude of gear-mesh frequency:
- Varies with the amount of defect that that grows with time
 - Does not vary at all
 - Only varies as the amplitude of the fundamental frequency changes
 - Varies only when misalignment of the gears increase over time
11. We can find the exact type or nature of the fault that causes vibration in a machine by studying the:
- Frequencies of the frequency spectrum
 - Relative difference of amplitudes in a frequency spectrum
 - Frequencies and phase difference
 - Design and function of the machine
12. Balancing by phase method might be a problem for balancing a flexible rotor at its operating speed because:
- The operating speed might be very close to a critical speed
 - The operator might read the phase angle wrongly
 - Phase angle information is actually not needed for 2 plane balancing
 - The phase angle might not be very steady for an accurate reading
13. Spike Energy/SPM (Shock Pulse Measurement)/ HFD (High Frequency Domain) measures the:
- Energy content of a acceleration waveform
 - The peak acceleration within a certain frequency band
 - The rms velocity in the high frequency region
 - The overall acceleration in the low frequency region
14. Correction weight is calculated as follows:
- $\text{Trial Weight (TW)} \times (\text{Original unbalance vector (OV)} / \text{Vector generated by Trial Weight})$
 - $\text{Trial Weight} \times \text{Vector generated by Trial Weight} / \text{Vector generated by OV} + \text{TW}$
 - $\text{Trial Weight} \times \text{Vector generated by TW} / \text{Vector of original unbalance vector (OV)}$
 - $\text{Trial Weight} \times 1.6 \times \text{Original Unbalance Vector (OV)}$