Date: Vibration Level 3 Competency Test Paper NAME:

Rubbing produces vibration which is:

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

Low frequency vibrations get:

a) Damped out very easily
b) Cancelled by high frequency vibration
c) Travel over very large distances
d) Can travel short distances but is dependent on the phase of vibration

Vibration amplitude at 1N is:

a) Proportional to the amount of unbalance masses
b) Proportional to the amount of defects present in the system
c) Proportional to the overall vibration reading taken in Displacement
d) Proportional to the strain energy in the system

Strain Energy of a system is equal to:

a) $\frac{1}{2} k x^2$
b) $\frac{1}{2} m v^2$
c) $\frac{1}{2} m a^2$
d) Phase difference

If we increase the mass of a vibrating body by 2 times, the body would now vibrate:

a) 2 times slower
b) 2 times faster
c) 1.14 times slower
d) 1.14 times faster

For a very slow moving bearing (say 2 RPM) we may monitor the condition of the bearing:

a) By measuring the RMS Velocity
b) Peak Acceleration at high frequencies
c) Enveloped acceleration spectrum
d) Spike energy

When journal bearings wear out the following might happen:

a) Displacement values would increase along with rise of temperature of the bearing
b) Velocity values would decrease along with a rise in temperature of the bearing
c) Only bearing temperature would increase
d) There would be resonance in the system

If the vibration on the horizontal direction is more than the vertical direction we may say:

a) That the unbalance force is quite high
b) The rigidity of the system in the horizontal direction is higher than the vertical direction
c) The bearing is faulty
d) That it might only happen when we take measurements in displacement mode only

Longer the span of a beam:

a) Lesser is the stiffness
b) Higher is the stiffness
c) The mode of vibration would be very complex
d) Acceleration values would be generally higher

If we want to isolate a machine from the effect of other harmful vibrations then:

a) We can use isolators with very high stiffness
b) We may use vibration absorbers
c) We may use isolators with very low stiffness
d) We may use vibration dampers

If we want to absorb the vibration of a machine we would only have to:

a) Use stiffer isolators
b) Use dynamic vibration absorbers
c) Use dynamic vibration absorbers having a resonant frequency equal to that of the machine
d) Use heavy foundations and/or structures

The human bones can pick up vibrations because:

a) It acts like a spring
b) It has properties of a piezo electric crystal
c) It deflects under load
d) It has both mass and stiffness and a certain amount of damping

We generally select velocity as a preferred vibration parameter:

a) Since most vibration instruments allow us to measure in velocity
b) Velocity has a constant gain over the frequency range
c) Velocity actually gives us more information about the real condition of the machine
d) It is easier to understand vibration through velocity measurements

At resonance the vibration amplitude never reaches infinity because:

a) In real system it is impossible for such a thing to happen
b) All real systems are very stiff
c) Vibration amplitudes decay exponentially
d) Gravity acts against the vibration

Spike Energy measures:

a) The peak velocity between 10, 000 CPM to 40, 000 CPM
b) The rms velocity between 10,000 CPM to 45, 000 CPM
c) The peak acceleration between 15, 000 CPM to 45,000 CPM
d) The peak acceleration between 45, 000 CPM to 85, 000 CPM

If a spring is elongated too much by an applied force then:

a) The stiffness of the spring increases
b) The stiffness of the spring remains the same
c) The stiffness of the spring decreases by half
d) The spring loses its stiffness completely

If a machine is mounted on 8 springs having equal stiffness of 'K' each then the combined stiffness of the system is:

a) 4K
b) 8K
c) K/4
d) 4K

At high speeds damping is proportional to:

a) velocity
b) square of the velocity
c) force imposed on the system
d) elasticity of the material

When we use enveloping technique for monitoring anti-friction bearing:

a) We can choose the frequency range of our interest
b) The frequency range is pre-determined by the instrumentation we select
c) We can select the harmonics of interest
d) We would always have to select the low frequency part of the spectrum

Acoustic Emission technique is based on the principle that:

a) Noise always accompanies vibration
b) Noise is always louder than vibration
c) When a material cracks or tears it generates a medium to high frequency sound of its own
d) While at high frequencies the vibration is attenuated the noise becomes audible

Machines in which the rotating mass is of a disk form (very low width impellers):

a) Dynamic balancing is a must
b) Static balancing is the only balance required
c) Need not be balanced
d) We need to take care of the couple unbalance

Unbalance happens:

a) When the rotating mass gets worn off
b) When the speed of rotation is very high
c) When the CG of the mass does not coincide with the CG of the shaft
d) When the mass and width of the rotor is high enough

The FFT of 'impact' would generate a:

a) A high frequency peak
b) Would have amplitude but with no definite frequency
c) Would generate a peak equal to the fundamental peak
d) Might not appear on the frequency spectrum since Fourier analysis can be performed

The Centrifugal force generated by a rotating disk would be equal to:

a) Mr^2, where M is the mass and r is the radius of the disc
b) Mw^2e, where w is the angular speed, e is the eccentricity and M is the mass
c) $\frac{1}{2} Mw^2e$
d) Amplitude of the nodes observed

If the balance weight of 100 gms to be fixed at a radius of 100 cms, what would be the weight if it has to be fixed at a radius of 50 cms:

a) 100 gms
b) 50 gms
c) 200 gms
d) 150 gms

A statically balanced rotor may be:

a) Dynamically balanced
b) Dynamically unbalanced
c) Dynamic unbalance would be negligible if the speed is low
d) Dynamic couple that creates a reaction force on the bearing

Any unbalance, whatever, in a rigid rotor can be corrected by:

a) Placing correction weights on one plane of the rotor
b) Placing correction weights on two planes of the rotor
c) Placing correction weights on two planes of the rotor at 90 degrees to each other
d) All of the above

One way to minimize unwanted vibrations in pipelines is by:

a) Supporting them symmetrically
b) Provide additional Springs to support them
c) Support the pipelines asymmetrically
d) Increase the rigidity of the pipelines

One dolphin can talk to another dolphin across the world because they:

a) Talk in extremely low frequencies
b) Talk in extremely high frequencies
c) They pass their communication from one dolphin to another
d) Dolphins can't talk

A machine mounted on a steel structure raised high above the ground would:

a) Generally vibrate more in the vertical direction
b) Generally vibrate more in the axial direction
c) Generally vibrate more in the horizontal direction
d) All of the above

In a vertical mounted machine:

a) We sometimes get a frequency that is half the critical speed
b) We never get a frequency that is half the critical speed
c) We may get harmonics of the critical speed
d) We may get a frequency that is close to the critical speed

If we remove the magnetic attachment on an accelerometer the transducer resonant frequency would:

a) Go down
b) Remain the same
c) Go up
d) Can't tell

If we want to observe the sidebands of a high Gear mesh frequency we then use:

a) Enveloping technique
b) Special FFT analysis
c) Cepstrum Analysis
d) Zoomed time waveform analysis

Use of Eddy current probes gives us an idea of:

a) The physical displacement of the shaft
b) The frequency of shaft vibration
c) The change in speed of shaft rotation
d) Oil whips

Cavitation phenomenon in centrifugal pumps is best detected by:

a) Observing the acceleration spectrum on the driven end bearing
b) Taking the peak acceleration on the delivery side of the pump
c) Taking the peak velocity on the suction pipeline
d) Taking the peak to peak displacement on the delivery pipeline

If the viscosity of the fluid pumped by a centrifugal pump changes we may expect:

a) Flow would continue to remain steady
b) Flow turbulence
c) Flow turbulence for a short period of time
d) All of the above

As the flights of a screw conveyor, conveying viscous fluid, wears out:

a) We can expect the vibration levels to dramatically increase
b) Only vibration in displacement would increase
c) No appreciable changes in vibration would take place
d) The vibration levels to drop

If one v-belt of a set of 6 v-belts snaps we may expect:

a) Vibration values to go up immediately
b) Vibration values to go down immediately
c) Vibration values would remain unaffected
d) All of the above might happen – it depends on the situation

As anti-friction bearing condition starts to deteriorate:

a) Wear Debris analysis would reveal the incipient problem ahead of vibration monitoring
b) Vibration would detect the problem much ahead of Wear Debris analysis
c) The displacement values generally tend to decrease in relation to velocity measured in rms
d) All of the above might occur

Bad anti-friction bearings produce:

a) Frequencies all over the velocity spectrum
b) Frequencies at only high frequency part of the spectrum
c) Vibrations at middle frequency part of the spectrum
d) Vibration frequencies below 10, 000 CPM

If a harmonic motion is described by the equation x = A sin wt, then acceleration would be:

a) $-Aw^2 Sin\ wt$
b) $Aw^2 Sin\ wt$
c) $Aw^2 Cos\ wt$
d) $-Aw^2 Cos\ wt$

Two vibrations $x_1 = 5 \sin 40t$ 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) 8 units, 3 units
b) 4 units, 1 unit
c) 9 units, 1 unit
d) 4.5 units, 1.5 unit

A rigid rotor is a rotor that operates:

a) Much below its critical speed
b) Much above its critical speed
c) Near to its critical speed
d) Exactly half of its critical speed

The main frequencies to look for in a frequency spectrum are:

a) The fundamental and the bearing peaks
b) The predominant peak and the harmonics of the fundamental peak
c) The fundamental and the predominant peaks
d) All the peaks in the signature

Generally a flexible rotor operates between:

a) The second and the third critical speed
b) The first and the second critical speed
c) 1000 CPM and the first critical speed
d) The third critical speed and 10,000 CPM

Any deterioration in a gear box can be understood by the study of:

a) Changes in the gear mesh frequency
b) Changes in the gear mesh frequency and the side bands frequencies
c) Changes in the side band frequencies
d) Changes in the side band frequencies and the fundamental frequencies

A fabricated gear box vibrates more since:

a) The gear box acts like an amplifier
b) The combined stiffness of the gear box lowers
c) The residual unbalance is triggered
d) The gear box goes into resonance

Lubrication starvation in an anti friction bearing would produce:

a) Noise in the low frequency region around the fundamental
b) White noise that can be seen below the fundamental frequency
c) High frequency noise band with the possible increase in spike energy levels
d) Increase the spike energy level only

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 1x N, 2 x N and 3 x N frequencies are quite high relative to other peaks
c) If difference in phase angle in the vertical and horizontal plane differs by 178 degrees
d) The value of the amplitude of 1 x N is around 80% of the combined amplitude values of all other peaks combined and phase angle difference two radial planes is around 90 degrees

If the geometrical position of a mechanical system at any instant can be expressed by two numbers then

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

A piston moving in a highly worn out cylinder is an example of:

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

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

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

A beam supported at two ends with a motor vibrating in the middle of the beam has:

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

From a frequency spectrum the amount of Damping can be estimated by knowing that it 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 the width of the peak measured in the middle
d) Always proportional to the acceleration and acts opposite to the direction of acceleration

The electrical equivalent of mechanical mass is:

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

Very high frequency vibrations always contain a:

a) Lot of energy
b) Very low energy levels
c) Very low amount of damping
d) Superimposition of other waveforms from external sources

For a very tall structure over 30 m in height, a displacement value of more than:

a) 300 microns may be considered dangerous
b) 1000 microns may be considered dangerous
c) 5000 microns may be considered dangerous
d) 50 microns may be considered as dangerous

Phase method of balancing may:

a) Give very wrong or erratic results
b) Does not work for flexible shafts
c) Give the same results if we balance a rotor without the phase method
d) Not work for horizontal shafts operating a half the critical speed

Rubbing in a system gives rise to:

a) Harmonics of the fundamental frequency
b) Periodic and harmonic vibrations of the fundamental frequency
c) Aperiodic vibrations and frequencies generated due to possible impacts
d) Sub-harmonic vibration of the fundamental frequency

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

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

The causes of vibration are:

a) Inertia forces
b) Space and looseness
c) Acceleration and deceleration
d) All of the above

Base line value is around 2 mm/s then the warning and alarm values would be:

a) 4 mm/s and 6 mm/s
b) 3.5 mm/s and 10 mm/s
c) 2.5 mm/s and 20 mm/s
d) 8 mm/s and 20 mm/s

If the base line value is 0.01 g then the warning and alarm levels would be:

a) 1g and 10 g
b) 0.56 g and 0.85 g
c) 0.1 g and 0.5 g
d) 1 g and 2 g

An instrument based plant predictive maintenance program would catch around:

a) 60 to 90% of all possible failure modes in the system
b) 20 to 30% of all possible failure modes in the system
c) 80 to 100% of all possible failure modes in the system
d) 30 to 50% of all possible failure modes in the system

If the MTBF of a system is around 2 years then the frequency of monitoring would be:

a) At least once a month
b) Once in a quarter fortnight
c) Once in four months
d) Once in six months

Failure modes of antifriction bearings are:

a) Age related in nature
b) Design related
c) Random in nature
d) All of the above

The acceleration level on a normal structure should not be more than:

a) The vibration levels measured on the bearing housings
b) Half the vibration levels measured on the bearing housings
c) 0.1 g
d) 1 g

If the normal vibration at the bearing housing is around 2 mm/s the vibration at the foundation should be:

a) Less than 2 mm/s
b) Less than 0.5 mm/s
c) More than 1 mm/s
d) More than 1.5 mm/s

The balance quality grade of G 6.3 usually means that:

a) Overall vibration levels should not exceed 6.3 mm/s
b) The eccentricity of the unbalance mass should not exceed 6.3 mm from the centre of the shaft
c) The overall vibration level should not exceed 63 microns
d) None of the above

In a double row roller bearing the bearing vibration peak appears at half the calculated bearing peak. This indicates that the damage:

a) Has taken place randomly across the bearing
b) The rollers got damaged
c) Only half the bearing surface got damaged
d) None of the above

The phase difference for a pure off set misalignment would be around:

a) 90 degrees
b) 270 degrees
c) 180 degrees
d) 90 to 180 degrees (fluctuating)

Usually the number of filters used to capture a real time signature (for trending) varies between:

a) 100 to 200
b) 400 to 800
c) 800 to 1200
d) 1200 to 1600

The principle of balancing is based on the fact that we should be left with:

a) Only one moment on a bearing with a restoring moment of the paired bearing
b) There should be no moments acting on the system
c) The eccentricity is to be eliminated completely
d) None of the above

Pinion damage in a gear box is indicated when:

a) The sidebands across the Gear Mesh Frequency are not mirror image of each other
b) When the gap between the individual peaks in the side bands are not equal
c) When the right hand side of the side bands is higher in amplitude compared to the left hand side
d) None of the above

In a certain case, the bearings looseness in the housing produced a significant rise of 1N peak. On replacement of the bearing the peak came down slightly but not to a satisfactory level. We can say:

a) The repair work has not be done accurately
b) The real cause of the problem was a couple unbalance
c) There is also looseness of the foundation bolts
d) In addition to the bearing problem misalignment also exists

In a typical plant:

a) 20% of the problems are random in nature
b) 50% of the problems are random in nature
c) Around 70 to 90% of the problems are random in nature
d) Less than 5% of the problems are random in nature

A bearing skewed in the housing would produce:

a) No significant change in vibration levels with any parameter
b) Would produce significant change in phase across the face of the bearing
c) Would produce significant change of phase across the face of the bearing and non-uniform distribution of temperature (to be captured by thermography)
d) The phase angle might not be very steady and fluctuate between 0 and 90 degrees

Correction weight is calculated as follows:

a) Trial Weight (TW) x (Original unbalance vector (OV)/ Vector generated by Trial Weight)
b) Trial Weight x Vector generated by Trial Weight/ Vector generated by OV + TW
c) Trial Weight x Vector generated by TW/ Vector of original unbalance vector (OV)
d) Trial Weight x 1.6 x Original Unbalance Vector (OV)

Pick the statement that appears most accurate or True:

a) Bad workmanship is the is the most common cause of increased vibration
b) Bad design and installation is the most common cause of increase vibration
c) Increase in vibration levels is a characteristic of the system
d) Minor changes in input conditions is the primary condition of change in vibration levels

Signature with Full Name/Department/ Plant: