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COURSE BROCHURE

Advanced Vibration Analysis Training Course

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Registered in the United Kingdom and Saudi Arabia

Advanced Vibration Analysis Training Course

Advanced Vibration Analysis is a 2-week training course for vibration analysts, rotating equipment engineers and condition monitoring leads, and it ends with a machine fault diagnosis dossier for a critical train. Unplanned trips of compressors, pumps and gearboxes now carry heavy production and safety costs, so fault calls must be earlier and better evidenced. Jupiter Prime Training runs this course for specialists who already read basic spectra.

Why Vibration Analysis Matters Now

Three forces are reshaping vibration practice. Wireless sensors and online systems now stream far more data than analysts can inspect by eye, so alarm logic and triage rules decide what gets attention. Variable speed drives make fixed-frequency spectra unreliable, pushing teams towards order-based methods. Operations leaders also expect a clear remaining-life opinion, not a list of peaks. A site that diagnoses well schedules repairs into planned outages; a site that diagnoses badly either opens healthy machines or misses a bearing until it seizes. The course rests on condition monitoring and reliability-centred maintenance RCM principles used across industry.

Who Gains Most from Vibration Analysis

- Route-based analysts who collect and interpret periodic readings on balance-of-plant machines
- Rotating equipment engineers who sign off repair scopes and overhaul intervals
- Condition monitoring leads who set alarm limits and report machine health to operations
- Reliability engineers who link vibration evidence to failure mode and root cause studies
- Turbomachinery specialists who review proximity probe data on fluid-film bearing machines

Monitoring groups from one site gain most when an analyst, an engineer and a lead attend together and agree a shared fault language.

Vibration Analysis Capabilities

Participants move from reading peaks to defending a fault call with phase, waveform and transient evidence.

- Apply spectrum, waveform and phase evidence together to separate unbalance, misalignment and looseness — repair scope approval
- Calculate bearing and gear mesh defect frequencies and track their sidebands — overhaul timing
- Interpret orbit and shaft centreline plots from proximity probes — turbomachinery trip reviews
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Test for resonance with run-up, coast-down and bump data — structural modification decisions
- Specify statistical and baseline alarm limits by machine class — monitoring route design
- Communicate fault severity and remaining-life opinion in plain terms — operations planners

Key Vibration Analysis Terms

- Time waveform — The raw amplitude-versus-time signal, used to reveal impacts, rubs and modulation hidden in a spectrum.
- Order tracking — Analysis that expresses frequency as multiples of running speed, keeping fault peaks aligned when speed varies.
- Orbit plot — The path of a shaft centre traced from two perpendicular proximity probes at one bearing.
- Bode plot — A chart of amplitude and phase against speed, used to locate critical speeds during transients.
- Operating deflection shape — The pattern of motion of a machine structure at a chosen frequency under running conditions.
- Envelope demodulation — Signal processing that extracts repetitive impact rates, such as early bearing defects, from high-frequency bands.

Vibration Analysis Day by Day

Day 1: Signal Foundations Revisited

- Transducer Selection and Mounting — Data Quality for Each Machine Class
- Sampling Rate, Lines and Windowing — Resolution Versus Collection Time
- Averaging Types and Overlap — Noise Rejection on Unsteady Machines
- Units and Integration Errors — Displacement, Velocity or Acceleration Choice
- Machine Criticality Ranking — Where Monitoring Effort Is Spent

Day 2: Reading the Spectrum in Depth

- Harmonic and Sideband Families — Separating Sources Within One Spectrum
- Log Versus Linear Amplitude Scales — Spotting Early Low-Level Faults
- Subsynchronous Peaks — Oil Whirl, Belt and Rub Indicators
- Noise Floor Raises — Lubrication and Cavitation Clues
- Spectral Pattern Library — Consistent Fault Calls Across Analysts

Day 3: Time Waveform Evidence

- Waveform Length and Resolution Settings — Capturing Impacts Reliably
- Peak, Crest Factor and Kurtosis — Impact Severity Screening
- Truncation and Modulation Patterns — Looseness Versus Rub Diagnosis
- Synchronous Time Averaging — Isolating One Gear Tooth
- Waveform and Spectrum Pairing — Stronger Fault Confirmation

Day 4: Phase Analysis in the Field

- Tachometer and Cross-Channel Phase — Reference Set-Up Choices
- Bearing-to-Bearing Phase Comparison — Misalignment Type Confirmation
- Bent Shaft and Cocked Bearing Signatures — Correcting Repair Scope
- Soft Foot and Frame Distortion Checks — Base Correction Priorities
- Phase Data Sheets — Repeatable Readings Across Routes

Day 5: Rolling Element Bearing Diagnosis

- Defect Frequency Calculation — Outer Race, Inner Race, Cage and Ball
- Envelope Demodulation Settings — Early Defect Detection Bands
- Bearing Fault Staging Model — Remaining-Life Opinion
- Lubrication Faults Versus Defects — Correct Maintenance Response
- Electrical Fluting and Bearing Currents — Motor Repair Specification

Day 6: Gearbox Diagnosis

- Gear Mesh and Hunting Tooth Frequencies — Locating the Damaged Stage
- Sideband Spacing Analysis — Eccentric or Cracked Gear Identification
- Planetary Gearbox Patterns — Interpreting Complex Mesh Families
- Cepstrum Analysis — Revealing Hidden Sideband Families
- Oil Debris and Vibration Correlation — Gearbox Intervention Timing

Day 7: Shaft Dynamics and Proximity Probes

- Orbit Shape Interpretation — Preload, Rub and Instability
- Shaft Centreline Plots — Bearing Clearance and Load Direction
- Slow-Roll Runout Compensation — Cleaner Fluid-Film Bearing Readings
- Full Spectrum Analysis — Forward and Reverse Precession
- Protection System Trip Review — Restart or Hold Decision

Day 8: Transients and Variable Speed

- Run-Up and Coast-Down Capture — Critical Speed Location
- Bode and Polar Plots — Separation Margin Assessment
- Order Tracking and Waterfall Plots — Variable Speed Drive Machines
- Bump Testing and Natural Frequencies — Resonance Confirmation
- Operating Deflection Shapes — Stiffening or Detuning Choice

Day 9: Alarm Limits and Monitoring Strategy

- Statistical Alarm Setting — Baseline Versus Population Limits
- Narrowband Alarm Bands — Fault-Specific Early Warning
- Online Versus Route Monitoring — Coverage for Each Criticality Tier
- Trend Analysis and Rate of Change — Inspection Interval Adjustment
- Machine Health Reporting Format — Severity Language for Planners

Day 10: Practising the Machine Fault Diagnosis Dossier

- Multi-Fault Case Analysis — Applying Spectrum, Waveform and Phase Evidence
- Bearing and Gear Case Review — Applying Defect Frequency Methods
- Transient Data Case — Applying Resonance and Orbit Interpretation
- Peer Challenge of Fault Calls — Confidence Grading Before Release
- Machine Fault Diagnosis Dossier — Completing the Critical Train Record

Applying Vibration Analysis After the Course

- Review alarm limits on the ten most critical machines using statistical baselines and narrowband fault bands
- Lead a phase and waveform survey on one recurring problem machine and issue a confidence-graded fault call

Vibration Analysis Questions FAQ

What is advanced vibration analysis and why does it matter now?

Advanced vibration analysis combines spectrum, waveform, phase, orbit and transient data to diagnose machine faults with confidence. It matters now because sensor data volumes and variable speed drives make simple peak-reading unreliable, and operations expect clear severity and timing advice.

Which roles gain most from advanced vibration analysis?

Analysts, rotating equipment engineers and condition monitoring leads gain most. You should already collect data and read basic spectra; the course builds the evidence needed to defend repair scopes, alarm settings and restart decisions on critical machines.

How does advanced vibration analysis differ from an introductory condition monitoring course?

It assumes basic spectrum reading and goes further into phase, waveform, orbits, order tracking and resonance testing. An introductory condition monitoring course surveys several technologies briefly; this one goes deep on diagnosis and alarm logic for rotating machines.

What do you bring back from advanced vibration analysis?

You bring back a structured fault diagnosis record for a critical train. It holds evidence from several methods, a confidence grade, a severity opinion and alarm settings, ready for review with engineering and operations colleagues.

Vibration Analysis: The Way Forward

The machine fault diagnosis dossier gives a critical train one evidenced record of faults, severity and alarm settings. Its first use is the repair-or-run decision at the next planned outage, taken by rotating equipment engineers and operations planners together. After that first use, revisit the alarm limits and confidence grades against what the strip-down actually found, and refine the fault library accordingly.