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## Applied Vibration Analysis – Advanced Category III

*Follows Category III Guidelines Established by ISO 18436-2, “Condition monitoring and diagnostics of machine – Requirements for training and certification of personnel – Part 2: Vibration condition monitoring and diagnostics”*

<b>Prerequisites:</b>	Two years or more training in mechanical technology or mechanical engineering at an accredited college, university or technical school is strongly recommended. Candidates should be able to manipulate simple algebraic equations, use a basic scientific calculator, and be familiar with the operation of personal computers.
<b>ISO Certification</b>	Requires 110 hours of formal training or independent study, Category II Certification, 36 months experience, and examination
<b>Course Length</b>	40 Hours
<b>Certification Exam</b>	100 questions, 4 hours time limit, closed book but a summary sheet of formulae is provided, passing score is 75% correct
<b>Maximum # Students:</b>	15

### Course Objectives

Students who successfully complete this course will be able to:

- select the appropriate machinery vibration analysis technique
- specify the appropriate vibration instrumentation hardware and software for both portable and permanently installed systems
- establish vibration monitoring programs, including the determination of machines for periodic and continuous monitoring, frequency of testing, route plans



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(Objectives continued)

- perform single plane field balancing
- measure and perform diagnosis of single-channel frequency spectra, as well as time domain plots such as waveforms and orbits, under both steady-state and unsteady operating conditions, with or without a phase trigger
- use acceleration enveloping (demodulation)
- establish and implement the use of statistical overall level alarms, spectral band alarms, and narrowband spectral alarms
- establish programs for the specification of vibration levels and acceptance criteria for new machinery
- measure and analyze basic operating deflection shapes
- report to management regarding program objectives, budgets, cost justification and personnel development
- understand and be able to direct the use of alternative condition monitoring techniques
- prepare reports for appropriate personnel on machine condition, recommend corrective action and report on the effectiveness of repairs
- recommend field corrective actions such as balancing, alignment and parts replacement
- provide instructions and technical direction to vibration trainees

## Syllabus and Seminar Schedule

### Day One

8:00AM – 9:50AM

#### Principles of Vibration

*Natural frequency and resonance, vectors, forced vs. free response, mass, damping, stiffness*

9:50AM – 10:10AM

*Break*



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**10:10AM – 12:00PM**

**Data Acquisition**

*Dynamic range, signal-noise ratio, triggering*

*12:00PM – 1:00PM*

*Lunch*

**1:00PM – 2:50PM**

**Signal Processing**

*Advanced analog and digital sampling, time windows, filters, anti-aliasing, bandwidth and resolution, averaging, FFT computation, spectral maps*

*2:50PM – 3:10PM*

*Break*

**3:10PM – 5:00PM**

**Practice Problems and Exercises**

**Day Two**

**8:00AM – 9:50AM**

**Signal Processing**

*Time domain, phase analysis, transients, orbits, shaft centerline, enveloping*

*9:50AM – 10:10AM*

*Break*

**10:10AM – 12:00PM**

**Condition Monitoring**

*Database setup and maintenance, narrowband and statistical alarms, alternative technologies*

*12:00PM – 1:00PM*

*Lunch*

**1:00PM – 2:50PM**

**Practice Problems and Exercises**

*2:50PM – 3:10PM*

*Break*

**3:10PM – 5:00PM**

**Fault Analysis**

*unbalance, misalignment, looseness, rubs and instabilities, rolling element and journal bearing defects, electric motors, flow induced, gearbox analysis, resonance, turbomachinery*



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**Day Three**

<b>8:00AM – 9:50AM</b>	<b>Practice Problems and Exercises</b>
<i>9:50AM – 10:10AM</i>	<i>Break</i>
<b>10:10AM – 12:00PM</b>	<b>Corrective Action</b> <i>Alignment, balancing, parts replacement, flow control,</i>
<i>12:00PM – 1:00PM</i>	<i>Lunch</i>
<b>1:00PM – 2:50PM</b>	<b>Corrective Action</b> <i>isolation and damping, resonance control</i>
<i>2:50PM – 3:10PM</i>	<i>Break</i>
<b>3:10PM – 5:00PM</b>	<b>Practice Problems and Exercises</b>

**Day Four**

<b>8:00AM – 9:50AM</b>	<b>Equipment Knowledge</b> <i>motors, pumps, turbines, compressors, reciprocating machines, rolling mills, paper machines, structures/piping, gearboxes, bearings, couplings, belts</i>
<i>9:50AM – 10:10AM</i>	<i>Break</i>
<b>10:10AM – 12:00PM</b>	<b>Practice Problems and Exercises</b>
<i>12:00PM – 1:00PM</i>	<i>Lunch</i>
<b>1:00PM – 2:50PM</b>	<b>Acceptance Testing</b> <i>Specs and standards, reporting</i>
<i>2:50PM – 3:10PM</i>	<i>Break</i>
<b>3:10PM – 5:00PM</b>	<b>Testing and Diagnostics</b> <i>Impact testing, transient analysis, operating deflection shapes</i>



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**Day Five**

**8:00AM – 9:50AM**

**Reference Standards**

*ISO, IEC, API, and others*

*9:50AM – 10:10AM*

*Break*

**10:10AM – 12:00PM**

**Reporting and Documentation**

*Condition monitoring reports, vibration diagnostics reports*

*12:00PM – 1:00PM*

*Lunch*

**1:00PM – 5:00PM**

**Certification Examination**