

# Curriculum

Bently Nevada recommends some step-by-step curriculum to grow the knowledge and expertise of your instrumentation and diagnostics team helping you in better monitoring your machines and solving potential issues. Curriculum can be customized to your profile, assets and specific learning objectives. Your team will leverage Bently Nevada culture, practice and expertise.

# Diagnostics

Targeted for audience such as CM Engineers, Reliability engineers, Rotating equipment engineers, Engineers involved with the design & acceptance testing.

# Technical Training

## Diagnostics Basic

1

### Asset Strategy to Asset Health

- Integrated APM
- Scope and Criticality
- Maintenance Strategy Development with RCM approach
- Simulation of Run to Failure
- Preventative & Predictive Maintenance
- Task Optimization
- CM Technologies & Reporting

— 3 days —

2

### Mobius ISO 18436 Cat.I

- Maintenance practices
- Condition monitoring
- Principles of vibration
- Vibration measurement
- Data acquisition
- Signal processing
- Vibration analysis
- Common fault conditions
- Setting alarm limits

— 4 days —

3

### Introduction to reliability engineering

- Reactive Cycle
- Reliability & Excellence
- Reliability Engineering Tools:
  - Root Cause Analysis
  - Reliability Centered Maintenance
  - Life Cycle Costing
  - Reliability Block Diagrams
  - Asset Criticality
  - Failure Mode Effects & Criticality

— 1 day —

4

### Mobius ISO 18436 Cat.II

- Principles of vibration
- Data acquisition
- Probes, sensors, accelerometers
- Signal Processing
- Vibration & fault analysis
- Equipment testing/diagnostics
- Successful CM program
- Acceptance Testing

— 5 days —

5

### Practical data collection

- Enterprise creation
- Machine building
- Instrumentation building
- Route building
- SCOUT Data collection techniques
- Plot reviews using S1

— 1 day —

# Technical Training

## Diagnostics Intermediate

1

### Machinery Diagnostics

- CM & diagnostics Intro
- Interpret Phase/steady state data/transient data
- Fundamental Synchronous response
- Single plane balance
- Detection of anomalies such as Fluid induced instability, rubs, preloads, shaft cracks etc..

— 5 days —

2

### System 1

- Online systems & data collection
- Machine Building
- Data Analysis & Diagnostics
- Condition Monitoring Based Variables & Alarms

— 3 days —

3

### Applied Diagnostics Workshop

- Analyze actual machine case histories using S1 and or ADRE databases
- Malfunctions covered are unbalance, loose parts, misalignment, shaft crack, rub etc.
- Machines covered are GTs, STs, Motors, pumps, centrifugal compressors etc.

— 5 days —

4

### Diagnostics assignment

- Real data cases analysis from customer data using S1 or ADRE as applicable
- Coaching on analysis methodology, report writing etc..

— 3 days —

5

### Mobius ISO 18436 Cat.III

- Signal processing
- Time waveform and phase analysis
- Dynamics and testing for natural frequencies
- Operating deflection shape
- Modal and FEA intro
- Rolling element bearing fault detection
- Electric motor testing

— 5 days —

# Technical Training

## Diagnostics Advanced

1

### Advanced Field Balancing

- Balancing fundamentals
- Balancing calculations and conventions
- Single plane balancing workshop
- Static/couple and Influence vector balancing with workshop
- Multiplane balancing using Bently balance

— 5 days —

2

### Mobius ISO 18436 Cat.IV online course

- Principles of vibration
- Signal processing
- Fault analysis
- Phase analysis
- Rotor/bearing dynamics
- Corrective action
- Equipment testing and diagnostics
- Fault severity determination

— 5 days —

3

### Advanced Machinery Dynamics

- Model of the rotor
- Bearing design
- Modal and ODS analysis
- Anisotropy
- Rotor model
- Torsional
- Malfunction detection and analysis

#### Mobius ISO18436 Cat.IV exam

— 5 days —

4

### Using System 1 Bently Performance

- Bently performance in S1
- Basic concepts of Thermodynamic performance
- Machine applications
- Monitoring performance of various machine types such as pumps, compressors, GTs, STs, Generators and Turboexpander

— 3 days —

5

### Decision Support Fundamentals

- Decision support overview
- Configuration of DS
- Building customs rules
- Inshpaks overview
- Solving problems with DS
- Demo of deployment management
- Self paced workshops

— 2 days —

# Instrumentation

Targeted for audience such as Instrument Technicians, Operation and Maintenance engineers.

# Technical Training

## Instrumentation Basic

1

### Fundamentals of vibration

- Vibration overview
- Vibration measurement
- Transducers overview

— 2 days —

2

### Transducers installation

- Vibration Transducers
- Proximity Transducer Operation
- Proximity Transducer Installation
- Seismic Transducer Operation & Installation
- Instrument Grounding

— 2 days —

3

### 3500 Operation & Maintenance

- 3500 functions
- Proximity transducers
- Alarms
- Maintenance
- Troubleshoot

— 3 days —

4

### System 1

- Online systems & data collection
- Machine Building
- Data Analysis & Diagnostics
- Condition Monitoring Based Variables & Alarms

— 3 days —

5

### Exam & Certificate

- Quiz
- Onsite On the Job Training audit

— 1 day —

# Technical Training

## Instrumentation Intermediate

1

### 3500 System Troubleshooting

- 6 self-paced videos + quiz
- 3500 configuration options
  - Events analysis
  - LEDs and buffered outputs
  - Faults at the rear of 3500
  - 3500 software tool
  - Linearity check

— 1 hour —

2

### 3500 RECIP monitoring

- Basic elements of a RECIP
- Monitoring and protection
- Crankshaft timing
- 3500/25 configuration
- 3500/70M configuration
- Rod drop and rod position
- 3500/72M configuration
- Probe calibration workshop
- 3500/77M configuration

— 1 day —

3

### 3500 system for TSI applications

- Overview of 3500 system
- 3300 proximity transducer
- LVDT operation
- Eccentricity
- Rotor speed and acceleration
- Differential expansion (complimentary and ramp)
- Case expansion

— 2 days —

4

### Bently Nevada monitoring systems

- Orbit60
- 2300
- ADAPT 3701
- Ranger Pro
- vbOnline Pro

— 1 to 3 days —

5

### Exam & Certificate

- Quiz
- Onsite On the Job Training audit

— 1 day —