



## **Measurement Systems Analysis**

(8 hours)

### **Audience and Purpose:**

Course is for Engineers, Scientists, and Managers who have direct responsibility for measurement evaluation, selection, and control. Course covers the basic concepts associated with Measurement Systems Analysis, repeatability, reproducibility, accuracy, linearity, stability, standards selection and use, calibration and compensation and measurement control.

### **Software:**

JMP, Excel

### **Course Objectives:**

As a result of the course, the participant will be able to:

1. Determine gage capability
2. Assess accuracy, linearity, stability, repeatability and reproducibility in test equipment
3. Design and deploy SPC for measurement control
4. Select and establish standards
5. Describe proper methods for instrument calibration and compensation
6. Conduct gage capability for inspection activities
7. Discuss how MSA impacts customer satisfaction

### **Course Outline:**

#### **Section I Introduction to MSA**

MSA is a key to systematic product development  
Background statistical principles  
Sources of error  
Focus on the measurement process

#### **Section II Terms & Definitions**

Repeatability  
Reproducibility  
Accuracy  
Linearity  
Stability

#### **Section III R&R, Linearity, & Accuracy**

2 factor crossed design for Variables MSA  
Repeatability & Reproducibility  
R&R and Capability Example  
Accuracy example  
Linearity example

#### **Section IV Correlation, Calibration and Compensation**

Correlation and compensation  
Soft compensation versus standard calibration  
Scatterplot Method  
Problems with  $r^2$



**Section V SPC for Measurement Control**

- Selection and utilization of Standards
- SPC for Measurement Control
- SPC using stable standards
- SPC using unstable standards

**Section VI MSA for Attributes**

- Operational Definitions
- Effectiveness, P(miss), P(false alarm)
- Kappa, escape rate and bias