

# Measuring Instruments

## CATALOG DESCRIPTION

This course will familiarize students with the precision measurement tools and techniques used in manufacturing and industry. Topics will include measurement equipment types and specifications, as well as the techniques for ensuring measurement accuracy and precision. Students will be instructed in the correct use of calipers, micrometers, multimeters, oscilloscopes, and other pertinent tools that will be used in the electrical and mechanical manufacturing fields.

## LEARNING OUTCOMES

- Understand why precision measurements are necessary
- Apply the unit prefixes used with large and small measurement values
- Understand what features or parameters are measured
- Understand the purpose of tolerances and specifications
- Correctly interpret the different methods used to indicate tolerance
- Calculate specification limits based on the indicated tolerances
- Understand the importance of both accuracy and precision in measurements
- Distinguish between accuracy and precision
- Understand the importance of calibration and explain how calibration may be performed
- Explain the factors that influence measurement precision
- Identify and explain the important measuring equipment specifications: range, discrimination, precision and calibration status
- Identify the measuring instruments commonly used to measure discrete part dimensions: length, depth, diameter, etc
- Explain how these measuring instruments function
- Specify the correct instruments to evaluate various part dimensions
- Demonstrate how to use gauge blocks to calibrate instruments and to set instruments to nominal dimensions
- Understand how calipers and micrometers work
- Identify the different types of calipers and micrometers
- Determine which type of caliper or micrometer is most appropriate to measure a particular part dimension
- Demonstrate how to properly use calipers and micrometers to measure part dimensions
- Understand the need for process instruments and process control
- Interpret the instrumentation bubbles used on engineering drawings
- Identify and explain the functions of instruments commonly used to measure level, pressure, temperature, and flow

- Identify and understand the function of common electrical and electronic measuring instruments: Voltmeters, Ammeters, Ohmmeters, Multimeters, Oscilloscopes, and Function Generators
- Demonstrate proper techniques in the use of common electrical and electrical measuring instruments
- Understand the importance of accurate and precise measurements
- Explain the need for a documented Inspection Procedure
- Explain the steps in measurement equipment maintenance
- Identify and explain the ways in which measurement variation can be reduced

## COURSE OUTLINE

1. Introduction and Unit Prefixes
  - a. Introduction to Measuring Instruments Assignment
  - b. Unit Prefix Assignment
2. Tolerances and Specifications
  - a. Discussion: How are tolerances determined
  - b. Calculating Tolerance and Specification Limits Assignment
3. Accuracy and Precision
  - a. Accuracy vs. Precision assignment
  - b. Calibration assignment
4. Measuring Equipment Specifications
  - a. Measuring Equipment Specifications Assignment
5. Measuring Instruments for Discrete Part Dimensions
  - a. Go-No Go Gauge Assignment
  - b. Lab activities
6. Micrometers and Calipers
  - a. Micrometer Selection Assignment
  - b. Measuring Instruments for Part Dimensions Quiz
  - c. Lab activities
7. Measurement Instruments for Process Instrumentation and Control
  - a. Process Instruments Assignment
  - b. Lab activities
8. Measurement Instruments for Electrical and Electronic Specifications
  - a. Measuring Instruments for Process and Electrical Specifications Quiz
  - b. Lab activities (worksheet included)
9. The Measurement Process
  - a. Lab activities

## METHOD OF INSTRUCTION

This is a hybrid course and will be taught using lectures, discussions, hands-on labs, and self-study

## Course Materials