

MACH 53 Course Outline as of Fall 2004

CATALOG INFORMATION

Dept and Nbr: MACH 53

Title: METROLOGY

Full Title: Metrology

Last Reviewed: 3/9/2020

Units		Course Hours per Week		Nbr of Weeks	Course Hours Total	
Maximum	4.00	Lecture Scheduled	3.00	17.5	Lecture Scheduled	52.50
Minimum	4.00	Lab Scheduled	3.00	17.5	Lab Scheduled	52.50
		Contact DHR	1.00		Contact DHR	17.50
		Contact Total	7.00		Contact Total	122.50
		Non-contact DHR	0		Non-contact DHR	0

Total Out of Class Hours: 105.00

Total Student Learning Hours: 227.50

Title 5 Category: AA Degree Applicable

Grading: Grade Only

Repeatability: 00 - Two Repeats if Grade was D, F, NC, or NP

Also Listed As:

Formerly:

**Catalog Description:**  
Metrology is the study of the science of precision weights, measurement, and inspection used in industry manufacturing. Students will become familiar with all types of handheld measuring devices, electronic and optical. Visits to local industries utilizing CMM (Coordinate Measuring Machines) and related inspection devices are included. Print reading will be used as a vehicle to support GD&T (Geometric & Dimensioning) inspection standards. Class also includes study of ISO (International Standards Organization), SPC (Statistical Process Control), and ASME (American Society of Mechanical Engineers) inspection standards.

**Prerequisites/Corequisites:**  
Completion of or concurrent enrollment in MACH 51 and MACH 80A AND IED 90A OR APTECH 90A.

**Recommended Preparation:**

**Limits on Enrollment:**

**Schedule of Classes Information:**  
Description: Students will become familiar with all types of handheld measuring devices,

electronic and optical. Visits to local industries utilizing CMM (Coordinate Measuring Machines) and related inspection devices are included. (Grade Only)

Prerequisites/Corequisites: Completion of or concurrent enrollment in MACH 51 and MACH 80A AND IED 90A OR APTECH 90A.

Recommended:

Limits on Enrollment:

Transfer Credit: CSU;

Repeatability: Two Repeats if Grade was D, F, NC, or NP

## **ARTICULATION, MAJOR, and CERTIFICATION INFORMATION:**

<b>AS Degree:</b>	<b>Area</b>	Effective:	Inactive:
<b>CSU GE:</b>	<b>Transfer Area</b>	Effective:	Inactive:
<b>IGETC:</b>	<b>Transfer Area</b>	Effective:	Inactive:
<b>CSU Transfer:</b>	Transferable	Effective: Fall 2000	Inactive: Summer 2012
<b>UC Transfer:</b>		Effective:	Inactive:

**CID:**

**Certificate/Major Applicable:**

Certificate Applicable Course

## **COURSE CONTENT**

### **Outcomes and Objectives:**

Upon completion of this course, the student will be able to:

1. Interpret blueprints and GD&T (Geometric Dimensioning & Tolerancing) symbols in order to verify dimensions of a machine part.
2. Calculate and convert machine part measurements using English and metric measures.
3. Verify parts measurements on a drawing using a micrometer reading.
4. Measure a part using Vernier principles.
5. Determine the geometric profile of a machine part.
6. Interpret the measurement of a machine part from a radius, diameter, or angle, relative to absolute, coordinate, and incremental systems.
7. Utilize the surface plates to measure angular units and perpendicularity parallelism with required accuracy in metric and U.S. systems.
8. Describe the application and operation of Coordinate Measuring Machines (CMM) and Non-Contact measuring tools.

### **Topics and Scope:**

- I. Dimensioning and Tolerancing
  - A. Gauging applications
  - B. Measurement tools and calculations
    1. calipers
    2. micrometers.

## II. Units of measurements system

- A. Converting International (S.I. Metric) to the English system
- B. Vernier scale principles

## III. Blueprint Reading

- A. Interpreting GD&T (Geometric Dimensioning & Tolerancing) symbols
- B. Dimensions representations on drawings using symbols
- C. Calculations to describe degrees (angular units)
  - 1. degrees
  - 2. minutes
  - 3. seconds
- D. Using log tables
- E. Utilizing sine bars and optical comparators

## IV. Cartesian principles

- A. Coordinate and polar dimensions
- B. Incremental dimensions
- C. Absolute dimensions, relative to the number line system

## V. Coordinate measuring machines (C.M.M.)

- A. Types
  - 1. manual
  - 2. video
- B. Relationships to Vernier principles in decimal system

## VI. Inspection Standards

- A. ISO (International Organization for Standardization)
- B. SPC (Standards of Professional Conduct)
- C. ASME (American Society of Mechanical Engineers)
- D. GD&T

### **Assignment:**

Representative assignments:

1. Assigned reading, 20 - 25 pages per week.
2. Weekly quizzes on assigned readings.
3. Given a print, interpret symbols, dimensions, and features of coordinate measurements made with metrology tools and features.
4. Evaluate symbols, dimensions, views, and notes on 10 - 12 drawings. Answer questions related to evaluation.
5. Select and visit 4 sites using C.M.M. practices, observing methods of inspection (metric and U.S. systems) with C.M.M. machines and support measurement tools and gages. Write a 2 page report on each site and present to class.
6. Given 10 parts, measure accuracy and consistency in relation to SPC standards. Write a 2-3 page lab report.
7. Measure assigned parts from prints to verify correct dimensions with micrometers, calipers, and comparators and fill in blanks on a blueprint.
8. Performance exam: Given a part, measure and insert dimensions on a blank print.
9. Oral report on a procedure for measuring a part (e.g., a gear).
10. Final exam.

### **Methods of Evaluation/Basis of Grade:**

**Writing:** Assessment tools that demonstrate writing skills and/or require students to select, organize and explain ideas in writing.

Site reports.

Writing  
10 - 20%

**Problem Solving:** Assessment tools, other than exams, that demonstrate competence in computational or non-computational problem solving skills.

Lab reports, Evaluate drawings.

Problem solving  
15 - 20%

**Skill Demonstrations:** All skill-based and physical demonstrations used for assessment purposes including skill performance exams.

Performance exams, Interpret dimensions on a drawing.

Skill Demonstrations  
15 - 20%

**Exams:** All forms of formal testing, other than skill performance exams.

Multiple choice, True/false, Matching items, Completion

Exams  
35 - 45%

**Other:** Includes any assessment tools that do not logically fit into the above categories.

Attendance and oral report.

Other Category  
10 - 15%

### **Representative Textbooks and Materials:**

Dimensioning and Tolerancing, The American Society of Mechanical Engineers, ASME Y14.5M-1998.

Print Reading for the Machine Trades, 2nd ed. Pouler, Wilfred. Delmar, 1995.

Print Reading for Engineering and Manufacturing Technology. Madsen, David. Delmar, 2004.