Course Outline

General Information

COURSE ID (CB01A AND CB01B)

DMT 92

COURSE TITLE (CB02)

Applied GD&T (ASME Y14.5m); Coordinate Measuring Machines (CMM)

COURSE CREDIT STATUS

Credit - Degree Applicable

EFFECTIVE TERM

Fall 2024

COURSE DESCRIPTION

The focus of this course is the interpretation of specifications and inspection procedures related to current ASME Y14.5 Geometric Dimensioning and Tolerancing (GD&T) standards. Applications and capabilities of precision measuring tools, including the computer-aided Coordinate Measuring Machine (CMM), used in manufacturing environments to inspect discrete complex parts. Machine and inspected part set-up for measuring form, orientation, and position call-outs is also demonstrated in this course.

FACULTY REQUIREMENTS

DISCIPLINE 1

Manufacturing Technology (Quality control, process control)

FSA

FHDA FSA - MACHINE TOOL TECH

COURSE FAMILY

Not Applicable

Course Justification

This course is a major employment preparation CTE course for our Design and Manufacturing Technologies day and evening programs. It is a CSU transferable course. It is intended to better prepare students for work in the advanced manufacturing and machining industry in the area of inspection, advanced print reading, and CMM programming and operation as advised by our industry advisory committee. This course is also a part of the CNC/Research & Development Machinist certificate.

Foothill Equivalency

DOES THE COURSE HAVE A FOOTHILL EQUIVALENT?

No

FOOTHILL COURSE ID

Formerly Statement

Course Development Options

BASIC SKILL STATUS (CB08)

Course is not a basic skills course.

GRADE OPTIONS

- Letter Grade
- Pass/No Pass

REPEAT LIMIT

0

Transferability & Gen. Ed. Options

Information below is subject to change. For the official listing of courses, their approval dates, and transfer credit limitations, check the De Anza catalog (by academic year), ASSIST.ORG (https://assist.org/) and C-ID.NET (https://c-id.net/).

TRANSFERABILITY

Transferable to CSU only

Units and Hours

Summary

MINIMUM CREDIT UNITS	4.0
MAXIMUM CREDIT UNITS	4.0

Weekly Student Hours

Type	In Class	Out of Class
Lecture Hours	3.0	6.0
Laboratory Hours	3.0	0.0

Course Student Hours

COURSE DURATION (WEEKS)

12.0

HOURS PER UNIT DIVISOR

36.0

Course In-Class (Contact) Hours

LECTURE

36.0

LABORATORY

36.0

TOTAL

72.0

Course Out-of-Class Hours

LECTURE

72.0

LABORATORY

0.0

NA

0.0

TOTAL

72.0

Prerequisite(s)

Print reading experience

Corequisite(s)

Advisory(ies)

- ESL 261 and ESL 265, or ESL 461 and ESL 465, or eligibility for EWRT 1A or EWRT 1AH or ESL 5
- Pre-algebra or equivalent (or higher), or appropriate placement beyond pre-algebra

Experience in blueprint reading

Limitation(s) on Enrollment

Entrance Skill(s)

General Course Statement(s)

Methods of Instruction

Lecture and visual aids
Discussion of assigned reading Quiz and examination review performed in class Collaborative learning and small group exercises Laboratory discussion sessions and quizzes that evaluate the proceedings weekly laboratory exercises

Assignments

A. Required reading assignments from text and supplemental handouts.
B. Skill exercises to practice GD&T and CMM assignments.
C. Written project that requires comprehension and application of GD&T.

Methods of Evaluation

A. Midterm exam and quizzes to evaluate comprehension of terms and concepts, as well as application skills related to GD&T and CMM.
B. Accuracy and completion of skills exercises to evaluate GD&T and CMM competencies.
C. Written project demonstrating critical thinking regarding the GD&T measurement plan, as well as comprehension and application of metrology concepts.
D. Final exam evaluated by the students ability to critically analyze and apply GD&T concepts examined throughout the course

Essential Student Materials/Essential College Facilities

Essential Student Materials:

- None

Essential College Facilities:

- Metrology lab

Examples of Primary Texts and References

Author	Title	Publisher	Date/Edition	ISBN
Madsen, David, Schwartz, Dennis	Geometric Dimension and Tolerancing	Goodheart-Wilcox	2022 / 10th	978-1-64564-643-3

Examples of Supporting Texts and References

None.

Learning Outcomes and Objectives

Course Objectives

- Explain ISO and ASME Y 14.5M Geometric Dimensioning and Tolerancing (GD&T).
- Interpret various form tolerances without datums
- Describe orientation tolerances and methods of inspecting them
- Explain the true position tolerances and methods of inspecting them
- Demonstrate the applications of coordinate measuring systems to inspect form, orientation and position callouts of mechanical parts

CSLOs

- Apply geometric dimensioning and tolerancing standards to interpret drawings and inspect manufactured parts.
- Demonstrate basic operation of the coordinate measuring machine to inspect manufactured parts.

Outline

A. Explain ISO and ASME Y 14.5M Geometric Dimensioning and Tolerancing (GD&T).
    1. System rationale, advantages, limitations and relationship to function.
    2. Geometric dimensioning and tolerancing characteristics and symbols.
    3. Maximum and minimum material principle.
    4. Datums.
    5. Standard rules.
    6. Distinction between profile, form, orientation, runout and location tolerances.
B. Interpret various form tolerances without datums
    1. Flatness.
    2. Straightness.
        a. Surface elements.
        b. Axis, with and without modifiers.
    3. Roundness (circularity).
        a. Cylinders.
        b. Cones.
        c. Spheres.
    4. Cylindricity.

C. Describe orientation tolerances and methods of inspecting them
    1. Datum definitions and applications.
    2. Parallelism.
        a. Surface, cylindrical size feature and axis.
        b. Effect of modifiers.
    3. Perpendicularity.
        a. Surfaces, cylindrical size feature and axis.
        b. Effect of modifiers.
    4. Angularity.
        a. Surface.
        b. Axis.
    5. Profile.
        a. Surface.
        b. Surface all around.
        c. Coplanar surfaces.
    6. Runout.
        a. Circular.
        b. Total.
        c. Axis, diameter and face datums.
D. Explain the true position tolerances and methods of inspecting them
    1. Concept, advantages and disadvantages.
    2. Three plane concept of datums.
        a. Specified datums.
        b. Implied datums.
    3. Position tolerance.
        a. For holes in relationship to feature size.
        b. For non-cylindrical features.
        c. Or mating parts.
        d. For coaxial gauges.
        e. Non-cylindrical gauges.
    4. Position and coordinate tolerance zone conversions.
    5. Concentricity.
    6. Symmetry.
E. Demonstrate the applications of coordinate measuring systems to inspect form, orientation and position callouts of mechanical parts
    1. Types of coordinate measuring machines.
        a. Utility grade.
        b. Direct computer controlled.
        c. High accuracy.
        d. Sources of error.
    2. Structure of the coordinate measuring machine.
        a. Scales.
        b. Axis.
        c. Surface plate.
        d. Environment.
    3. Probing systems.
        a. Solid probes.
        b. Touch trigger.
        c. Analog probes.
        d. Sources of error.
    4. Scanning vs point to point measurement, datum simulation and assembly.
    5. Alignment.
        a. Right hand rule.
        b. Primary secondary and tertiary datum alignment.
    6. Measuring form.
        a. Flatness.
        b. Straightness.
        c. Circularity.
        d. Cylindricity.
    7. Measuring orientation.
        a. Angularity.
        b. Perpendicularity.
        c. Parallelism.
    8. Measuring location.
        a. Position.
        b. Concentricity.
    9. Measuring profile.
    10. Assembly of a measurement plan.

Lab Topics

A. Inspecting tolerances
B. True position tolerances
C. Orientation tolerances
D. Form tolerances

E. CMM operation
F. CMM modular fixturing