EL CAMINO COLLEGE

COURSE OUTLINE OF RECORD

I. Course Information

Course Acronym:* CADD

Course Number:* 45

Descriptive Title:* Geometric Dimensioning and Tolerancing

Division: Industry and Technology

Department:* Computer Aided Design/Drafting

Course Disciplines: Drafting

Catalog Description:* This course covers the application and interpretation of Geometric Dimensioning and Tolerancing (GD&T) as prescribed by the American Society of Mechanical Engineers (ASME) Y14.5 2018 standard. It includes tolerance zone generation and interpretation using Maximum Material Condition (MMC), Least Material Condition (LMC) and Regardless of Feature Size (RFS) principles. Also covered are datum referencing and simulation, tolerances of form, orientation, runout, position and bonus tolerances. The course emphasizes the identification and use of datums and positional tolerances.

Conditions of Enrollment:

Prerequisite:

Co-requisite:

Recommended Preparation:

Enrollment Limitation:

Course Length: Full Term

Hours Lecture (per week): 3

Hours Laboratory (per week): 0

Outside Study Hours:* 6

Total Course Hours:* 54

Course Units:* 3

Grading Method: Letter Grade only

Credit Status: Credit, degree applicable

Transfer CSU: Yes

Effective Date: Prior to July 1992

Transfer UC: No

Effective Date:

General Education: ECC

Term:

Other:

CSU GE:

Term:

Other:

IGETC:

Term:

Other:

II. Outcomes and Objectives

A. Student Learning Outcomes (SLOs) (The course student learning outcomes are listed below.)
SLO revisions are completed via the SLO Change Form available on the College Curriculum Committee website.

Student Learning Outcomes:

SLO #1 Detecting Errors and Omissions
Given sample engineering drawing whose dimensioning and tolerancing is done with Geometric Dimensioning and Tolerancing, the student will be able to point out errors and omissions in the application of dimensions and tolerances.

SLO #2 Revising Incomplete Drawings
Given an incomplete sample engineering drawing, the student will be able to revise the drawing to completely specify desired geometry and permissible variation of geometric characteristics utilizing appropriate symbology per the ASME Y14.5 Standard.

SLO #3 Applying Geometric Controls
Given a sample engineering drawing of a machined part without dimensioning and tolerancing and a description of the part's function, the student will be able to correctly apply dimensions, tolerances and datum identifiers.

B. Course Objectives (The major learning objective for in this course are listed below.)

Course Objectives:

1. Understand symbols for tolerances of form, location and orientation.
2. Analyze the use of modifying symbology.
3. Analyze worst-case conditions created by combinations of size, form, and positional tolerances.Revise an incomplete sample engineering drawing to completely specify desired geometry and permissible variation of geometric characteristics.
4. Analyze functional requirements of a sample part and identify appropriate datum features.
5. Evaluate various tolerance proposals and select the most functionally appropriate.
6. Compare and contrast conventional tolerancing with geometric tolerancing.

III. Outline of Subject Matter

(Topics should be detailed enough to enable an instructor to determine the major areas that should be covered to ensure consistency from instructor to instructor and semester to semester.)
Example:

I. Main Topic (3 hours, lecture)
- **A. Sub topics**
- **B. Sub topics**
  - **1. Super sub topic**
  - **2. Super sub topic**

Major Topics:

I. OVERVIEW OF GEOMETRIC AND POSITIONING TOLERANCING (3 hours, lecture)

1. Definition of tolerancing
2. Tolerancing methods
    1. Conventional
    2. Geometric
    3. Standardized
3. Tolerancing myths
4. History of geometric tolerancing
5. Benefits of geometric tolerancing

II. BASIC CONCEPTS (3 hours, lecture)

1. Fundamental rules of dimensioning and tolerancing
2. Types of tolerances
    1. Unilateral
    2. Bilateral
    3. Limits
    4. Notes and standards
    5. Geometric tolerances
3. Symbology

III. TOLERANCES OF FORM (5 hours, lecture)

1. Flatness
2. Straightness
3. Circularity
4. Cylindricity

IV. TOLERANCES OF ORIENTATION (4 hours, lecture)

1. Angularity
2. Perpendicularity
3. Parallelism

V. DATUMS (9 hours, lecture)

1. Definition
2. Three-plane concept
    1. Primary
    2. Secondary
    3. Tertiary
3. Datum feature versus datum plane versus datum simulator
4. Planes, points, lines, cylinders
5. Partial surface datums

5. Partial surface datums
    1. Datum target points
    2. Equalizing datums
    3. Step datums
6. Required accuracy of datum features
7. Datum features of size
8. Criteria for selection of datum features
9. Criteria for determining datum sequencing
10. Special cases
11. Compound datum systems
    1. Multiple datum systems
    2. Separate requirement datums for multiple patterns of features

VI. POSITIONAL TOLERANCES-BASIC (6 hours, lecture)

1. True position theory
    1. Coordinate location
    2. Cylindrical tolerance zone
    3. Wide tolerance zone
    4. Axis/center plane control versus boundary control
    5. Position as a single characteristic
    6. Single feature controls
2. Patterns of features
    1. Single tolerance
    2. Composite tolerance
    3. Non-cylindrical features

VII. POSITIONAL TOLERANCE APPLICATIONS (12 hours, lecture)

1. Mating parts
    1. Fixed fastener
    2. Floating fastener
    3. Multiple patterns
2. Tolerances greater in one direction
3. Conical tolerance zone
4. Projected tolerance zone
5. Coaxial features
    1. Positional tolerance
    2. Concentricity tolerance
6. Composite positional tolerances
    1. Pattern tolerance
    2. Feature tolerance
7. Effect of modifiers

7. Effect of modifiers
    1. MMC
    2. LMC
    3. RFS
    4. Zero tolerance at MMC
8. Former practices
    1. Symmetry
    2. Implied datums
    3. Bilateral pattern tolerances

VIII. ADVANCED APPLICATIONS (12 hours, lecture)

1. Worst case tolerance studies
2. Design documentation review
3. Interpretation of inspection results
4. Functional gage design
    1. Receiver gages
    2. Effect of modifiers of gage design
    3. Gaging policies: absolute, tolerant, permissive

Total Lecture Hours:	54
Total Laboratory Hours:	0
Total Hours:	54

IV. Primary Method of Evaluation and Sample Assignments

A. Primary Method of Evaluation (choose one):

1) Substantial writing assignments

2) Problem solving demonstrations (computational or non-computational)

3) Skills demonstrations

Primary Method of Evaluation:	2) Problem solving demonstrations (computational or non-computational)

B. Typical Assignment Using Primary Method of Evaluation

Typical Assignment Using Primary Method of Evaluation:	Given a dimensioned and toleranced engineering drawing, calculate worst-case maximum and minimum clearances and interferences. Diagram your findings on a one-page worksheet and submit to the instructor.

C. College-level Critical Thinking Assignments

Critical Thinking Assignment 1: Analyze actual measurements of a part and compare to requirements specified on the engineering drawing to determine if it can be accepted as is, needs to be reworked or must be rejected. Submit your determination on a one-page worksheet and submit to the instructor.

Critical Thinking Assignment 2: Design an object or mechanism on CADD software. Assign datums and specify tolerances suitable to its function using appropriate symbology. Create a fully dimensioned engineering drawing and submit to the instructor.

D. Other Typical Assessment and Evaluation Methods

Examples: **Class Performance, Objective Exam, Clinical Evaluation, Oral Exams, Completion, Other Exams, Embedded Questions, Performance Exams, Essay Exams, Presentation, Fieldwork, Quizzes, Homework Problems, Reading Reports, Journal kept throughout course, Term or Other Papers, Laboratory Reports, True/False, Matching Items, Written Homework, Multiple Choice, Other (specify)**

Other Evaluation Methods:
Completion
Homework Problems
Matching Items
Multiple Choice
Other Exams
Performance Exam
Quizzes
True/False

V. Instructional Methods

Examples: **Lecture, Group Activities, Lab, Role play/simulation, Discussion, Guest Speakers, Multimedia presentations, Field trips, Demonstration, Other (specify)**

Instructional Methods:
Demonstration
Discussion
Lecture
Multimedia presentations

If other: Design exercises

Note: In compliance with Board Policies 1600 and 3410, Title 5 California Code of Regulations, the Rehabilitation Act of 1973, and Sections 504 and 508 of the Americans with Disabilities Act, instruction delivery shall provide access, full inclusion, and effective communication for students with disabilities.

VI. Work Outside of Class

Work Outside of Class:*

Answer questions
Problem solving activity
Required reading
Skill practice
Study

If Other:

VII. Texts and Materials

A. Up-to-date Representative Textbooks: Please use the following format(s):

Printed Text - Author, Title, Edition, Publisher, Year.
Digital Text (OER Text) - Author (last name first). Title. Edition or Version (if beyond 1st). Publisher, Publication year or Revision date. URL. License.
***Sample:** Dillon, Dave. Blueprint for Success in College and Career. Version 1.3. Rebus Community, 2018. press.rebus.community/blueprint2/. Licensed under CC BY 4.0.*

If you wish to list a text that is more than 5 years old, please annotate it as a "discipline standard".

***Multiple textbooks may be listed.**

Up-To-Date Representative Textbooks:

Bruce Wilson. APPLICATION AND INTERPRETATION OF GEOMETRIC DIMENSIONING AND TOLERANCING. Goodheart Wilcox, 2021.

Bruce Wilson. APPLICATION AND INTERPRETATION OF GEOMETRIC DIMENSIONING AND TOLERANCING - STUDY GUIDE. Goodheart Wilcox, 2021.

B. Alternative Textbooks: Please use the following format(s): if applicable

Printed Text - Author, Title, Edition, Publisher, Year.

Digital Text (OER Text) - Author (last name first). Title. Edition or Version (if beyond 1st). Publisher, Publication year or Revision date. URL. License.

***Sample:** Dillon, Dave. Blueprint for Success in College and Career. Version 1.3. Rebus Community, 2018. press.rebus.community/blueprint2/. Licensed under CC BY 4.0.*

If you wish to list a text that is more than 5 years old, please annotate it as a "discipline standard".

***Multiple textbooks may be listed.**

Alternative Textbooks:

C. Required Supplementary Readings

Required Supplementary

Readings:

D. Other Required Materials

Other Required Materials:

VIII. Conditions of Enrollment

A. Requisites (Course Prerequisites and Corequisites) Skills needed without which a student would be highly unlikely to succeed.

Requisite:

Category:

Requisite course(s): List both prerequisites and corequisites in this box.

Requisite and Matching skill(s):Bold the requisite skill. List the corresponding course objective under each skill(s).

B. Requisite Skills: (Non-Course Prerequisite and Corequisites) Skills needed without which a student would be highly unlikely to succeed.

Requisite Skill:

Requisite Skill and Matching Skill(s): Bold the requisite skill(s). If applicable

C. Recommended Preparations (Course) (Skills with which a student's ability to succeed will be strongly enhanced.)

Requisite course:

Requisite and Matching skill(s):Bold the requisite skill. List the corresponding course objective under each skill(s).

D. Recommended Preparation (Non-Course) (Skills with which a student's ability to succeed will be strongly enhanced.)

Requisite Skill:

Requisite Skill and Matching skill(s): Bold the requisite skill. List the corresponding course objective under each skill(s). If applicable

E. Enrollment Limitations

Enrollment Limitations and Category:

Enrollment Limitations Impact:

Course Created by: Rick Hughes **Date:** 10/30/2015

Original Board Approval Date: 02/11/1991

Last Reviewed and/or Revised by: Allen Bakalyar **Date:** 11/15/2021

Last Board Approval Date: 01/18/2022