MACH 163 Course Outline as of Spring 2021

CATALOG INFORMATION

Dept and Nbr: MACH 163 Title: METROLOGY
Full Title: Metrology
Last Reviewed: 3/9/2020

Units		Course Hours per Week		Nbr of Weeks	Course Hours Total	
Maximum	3.00	Lecture Scheduled	3.00	17.5	Lecture Scheduled	52.50
Minimum	3.00	Lab Scheduled	0	17	Lab Scheduled	0
		Contact DHR	0		Contact DHR	0
		Contact Total	3.00		Contact Total	52.50
		Non-contact DHR	0		Non-contact DHR	0

Total Out of Class Hours: 105.00 Total Student Learning Hours: 157.50

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:	MACH 53

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

Prerequisites/Corequisites:
Completion of or concurrent enrollment in MACH 51A; and Course Completion or Concurrent Enrollment in IED 90A or APTECH 90A

Recommended Preparation:
Eligibility for ENGL 100 or ESL 100 or appropriate placement based on AB705 mandates

Limits on Enrollment:

Schedule of Classes Information:
Description: Metrology is the study of the science of precision weights, measurement, and

inspection used in manufacturing. Students will become familiar with all types of handheld electronic and optical measuring devices. Visits to local industries utilizing Coordinate Measuring Machines (CMM) and related inspection devices are included. Print reading will be used as a vehicle to support Geometric Dimensioning & Tolerancing (GD&T) inspection standards. Class also includes study of International Standards Organization (ISO), Statistical Process Control (SPC), and American Society of Mechanical Engineers (ASME) inspection standards. (Grade Only)
Prerequisites/Corequisites: Completion of or concurrent enrollment in MACH 51A; and Course Completion or Concurrent Enrollment in IED 90A or APTECH 90A
Recommended: Eligibility for ENGL 100 or ESL 100 or appropriate placement based on AB705 mandates
Limits on Enrollment:
Transfer Credit:
Repeatability: Two Repeats if Grade was D, F, NC, or NP

ARTICULATION, MAJOR, and CERTIFICATION INFORMATION:

AS Degree:	**Area**	Effective:	Inactive:
CSU GE:	**Transfer Area**	Effective:	Inactive:
IGETC:	**Transfer Area**	Effective:	Inactive:

CSU Transfer:	Effective:	Inactive:
UC Transfer:	Effective:	Inactive:

CID:

Certificate/Major Applicable:
Certificate Applicable Course

COURSE CONTENT

Student Learning Outcomes:
At the conclusion of this course, the student should be able to:
1. Analyze engineering blueprints and drawings to identify feature control frames, tolerances and measurement practices.
2. Demonstrate technical skills in keeping with the demands of 21st century manufacturing.

Objectives:
At the conclusion of this course, the student should be able to:
1. Calculate and convert machine part measurements using US and metric measures.
2. Verify parts measurements on a drawing using a micrometer reading.
3. Measure a part using Vernier principles.
4. Determine the geometric profile of a machine part.
5. Interpret the measurement of a machine part from a radius, diameter, or angle, relative to absolute, coordinate, and incremental systems.
6. Utilize the surface plates to measure angular units of perpendicularity and parallelism with required accuracy in metric and US systems.
7. Describe the application and operation of Coordinate Measuring Machines (CMM) and non-contact measuring tools.

Topics and Scope:

I. Understanding Dimensions and Tolerances
   A. Gauging applications
   B. Measurement tools and calculations
      1. Calipers
      2. Micrometers
II. Units of Measurements System
   A. Converting metric to the US system
   B. Vernier scale principles
III. Blueprint Reading
   A. Interpreting Geometric Dimensioning & Tolerancing (GD&T) 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 Coordinates
   A. Coordinate and polar dimensions
   B. Incremental dimensions
   C. Absolute dimensions, relative to the number line system
V. Coordinate Measuring Machines (CMM)
   A. Types
      1. Manual
      2. Video
   B. Relationships to Vernier principles in decimal system
VI. Inspection Standards
   A. International Organization for Standardization (ISO)
   B. Standards of Professional Conduct (SPC)
   C. American Society of Mechanical Engineers (ASME)
   D. GD&T

Assignment:

1. Assigned reading, 20 - 25 pages per week
2. Given a print, interpret symbols, dimensions, and features of coordinate measurements made with metrology tools and features.
3. Evaluate 10 - 12 drawings on symbols, dimensions, views, and notes. Answer questions related to evaluation.
4. Given 10 parts, measure accuracy and consistency in relation to SPC standards. Write a 2-3 page report(s).
5. Measure assigned parts from prints to verify correct dimensions with micrometers, calipers, and comparators and fill in blanks on a blueprint.
6. Performance exam(s): Given a part, measure and insert dimensions on a blank print
7. Oral report on a procedure for measuring a part (e.g., a gear)
8. Quizzes and 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.

Report(s), Evaluate drawings	Problem solving 15 - 20%

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

Performance exam(s), Interpret dimensions on a drawing	Skill Demonstrations 15 - 20%

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

Quizzes and Final exam	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, 8.2. The American Society of Mechanical Engineers. ASME Y14.5M-2018.
Print Reading for Engineering and Manufacturing Technology. Madsen, David. Delmar. 2019.